December 17, 1956 50 Cents

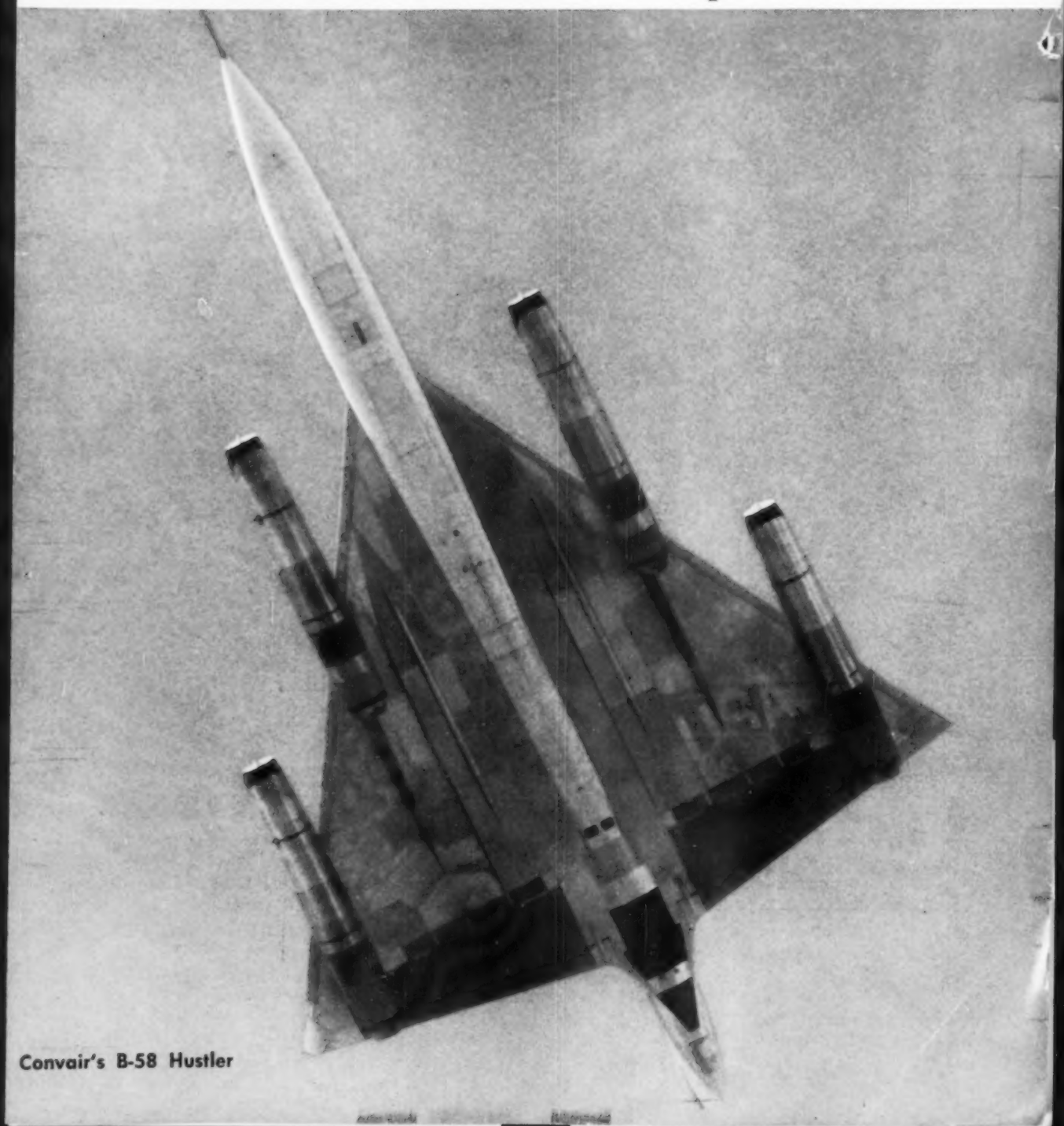
AVIATION WEEK

A McGRAW-HILL PUBLICATION

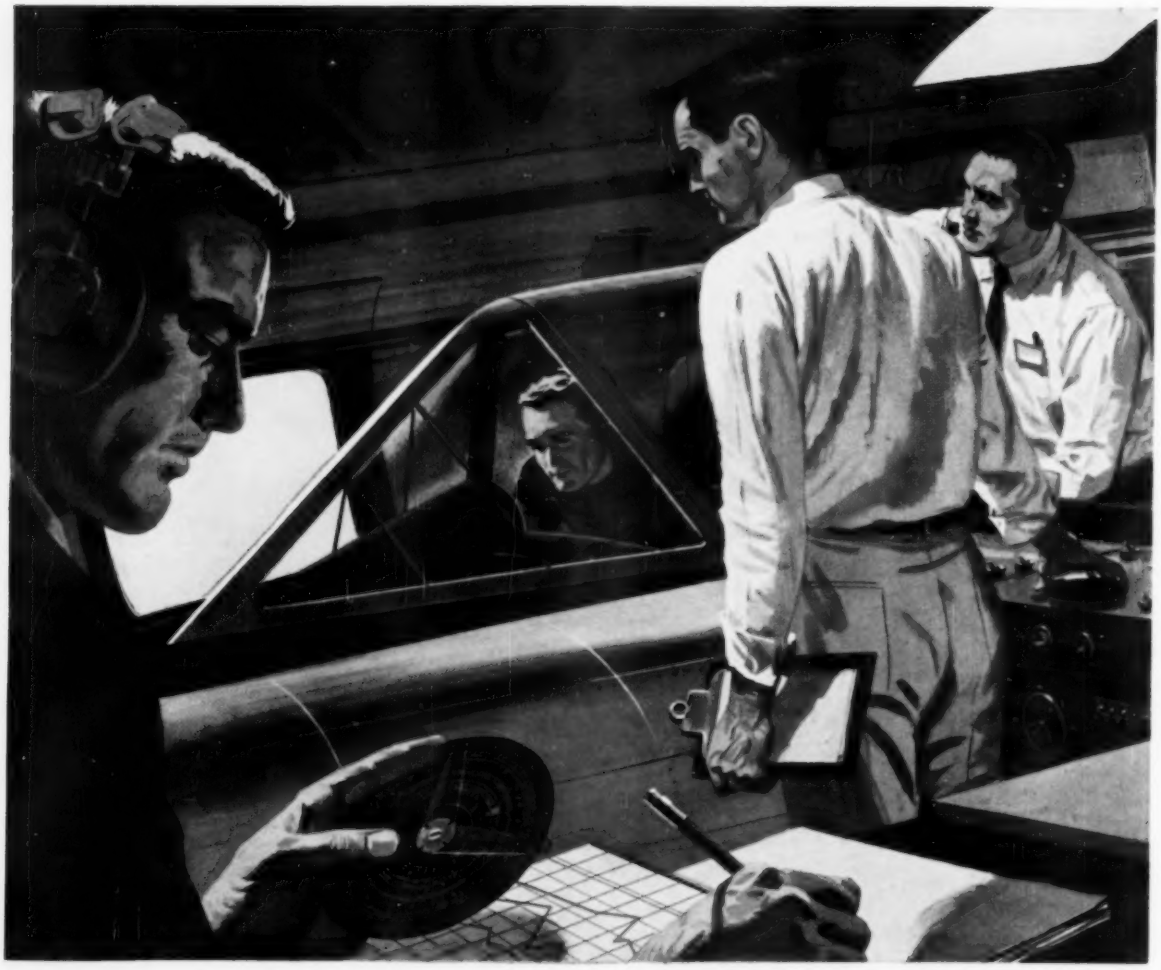
Civil Training Saves Millions for USAF

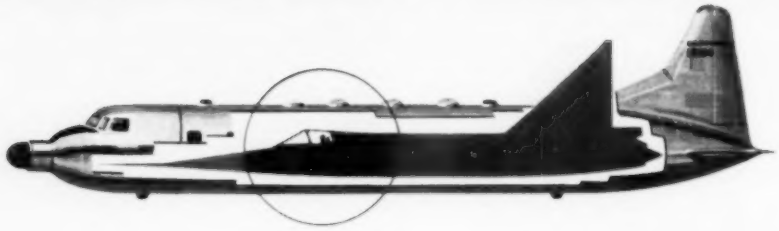
•

Wingtip Vortices Light Plane Hazard?



Convair's B-58 Hustler



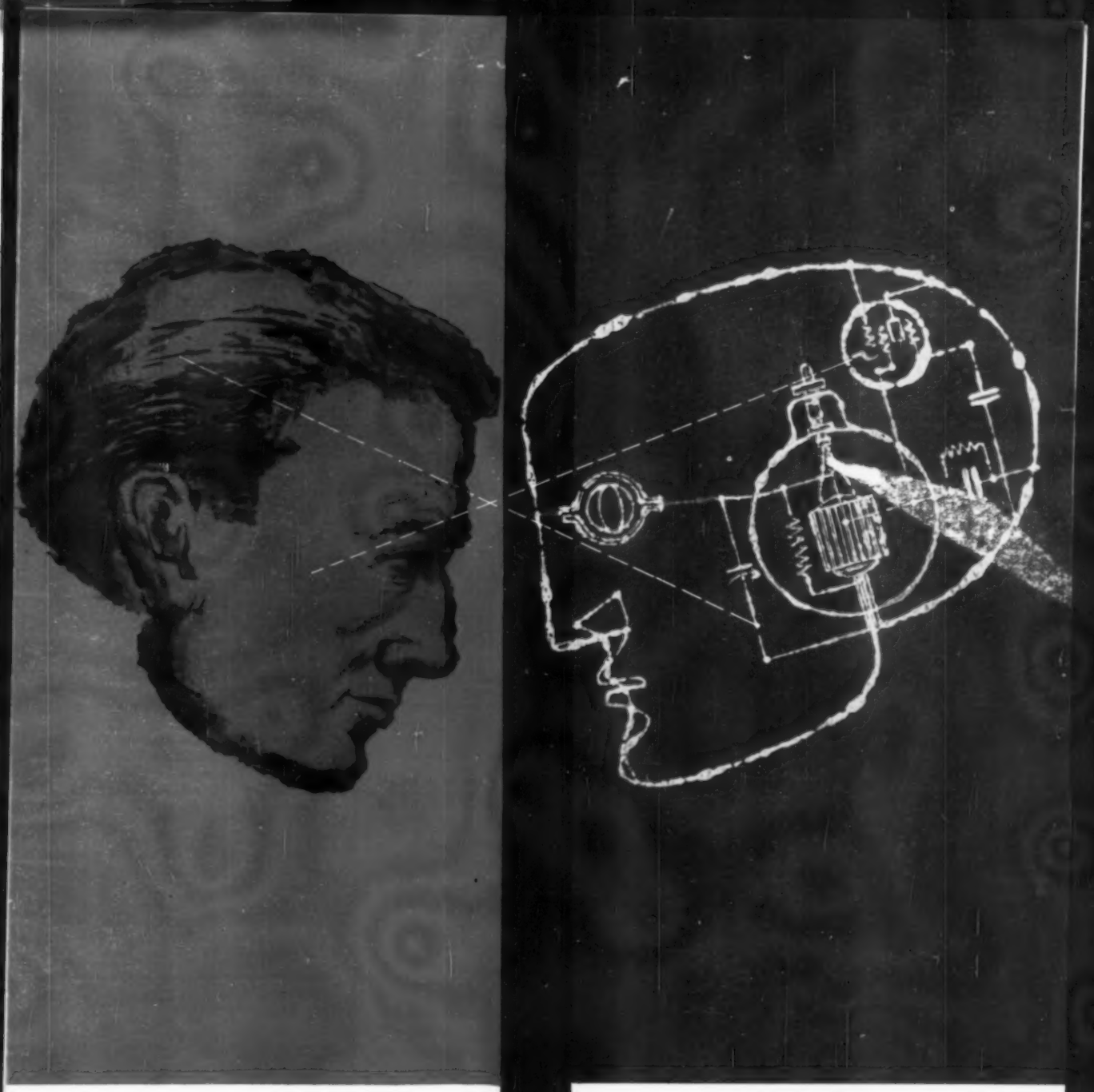


Engineering to the Nth power...INSIDE AND OUT!

Installed inside a Convair T-29 is an actual cockpit of Convair's delta-wing F-102A all-weather interceptor. Once aloft, the "back seat" pilot flies the T-29 by performing all the functions of a F-102A interceptor pilot. At the same time, scientists and engineers evaluate system performance and a psychologist checks pilot reaction. This use of the T-29 as a flying laboratory by Hughes Aircraft Company, Culver City, California, flight tests the F-102A's advanced electronic weapon system with far more efficiency than ever before – and at a fraction of the cost. A "plane within a plane"–and both Convairs! Another dramatic example of **Engineering to the Nth power** working for the defense of our country!

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION



HOW TO IMPROVE A MISSILE'S IQ

Today's guided missile is an amazingly sophisticated and intelligent instrument, capable of complex thought and precise action. Tomorrow's must have an even higher IQ.

To improve a missile's intelligence, Fairchild Guided Missiles Division engineers and scientists have developed radical new concepts for guidance and control, transferring their intelligence into the missile's guidance center.

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FAIRCHILD

GUIDED MISSILES DIVISION • WYANDANCH, LONG ISLAND, N. Y.

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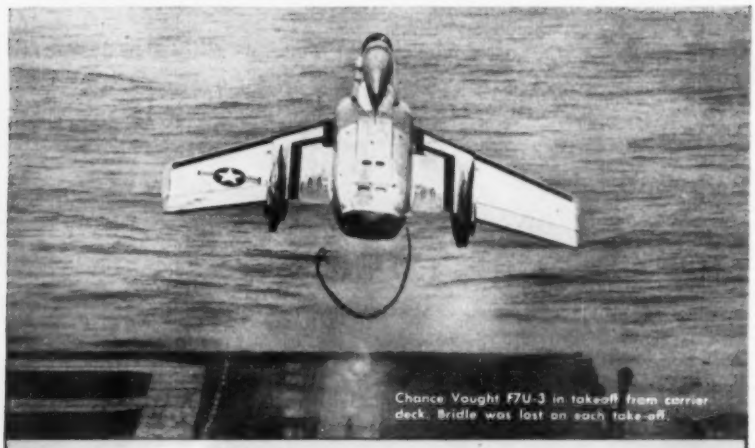
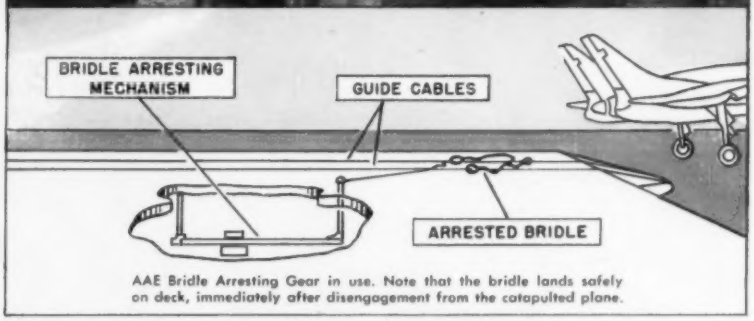
...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

NO MORE LOST BRIDLES...



Chance Vought F7U-3 in take-off from carrier deck. Bridle was lost on each take-off.



AAE Bridle Arresting Gear in use. Note that the bridle lands safely on deck, immediately after disengagement from the catapulted plane.

THANKS TO ALL AMERICAN HIGH-CAPACITY BRIDLE ARRESTERS

In catapulting jets from the decks of aircraft carriers, each flight used to mean the loss over the side of the catapult bridle.

The U. S. Navy has now installed All American's Hi-Capacity Bridle Arresting Gear on all aircraft carriers equipped with steam catapults. Bridles are now saved for re-use.

This is another engineering project that spotlights All American's dynamic leadership in design, development and testing of new, vital equipment for the Armed Forces.

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AVIATION CALENDAR

Dec. 28-31—Third King Orange International Model Plane Contest, U. S. Marine Corps Air Station, Miami, Fla.

Jan. 8-9, 1957—15th Annual Miami-Havana Air Cruise, sponsored by Florida Air Pilot's Assn. For details write: James G. Page, cruise director, FAPA, 310 S.E. 2d Ave., Miami, Fla.

Jan. 14-16—National Symposium on Reliability and Quality Control in Electronics, sponsored by IRE, ASQC, AIEE and RETMA, Hotel Statler, Washington, D.C.

Jan. 21-22—Symposium on Solar Furnace Design and Operation, Hotel Westward Ho, Phoenix, Ariz.

Jan. 27-28—American Society for Metals, Albuquerque and Los Alamos Chapters, "Heat Tolerant Metals for Aerodynamic Applications," Albuquerque, N. M.

Jan. 28-31—8th Plant Maintenance & Engineering Conference, Public Auditorium, Cleveland, Ohio.

Jan. 28-31—25th Annual Meeting, Institute of the Aeronautical Sciences, Sheraton-Astor Hotel, New York, N. Y. Honors Night Dinner, Jan. 28.

Jan. 31—Sixth Annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif. Additional course will be held Feb. 1.

Feb. 7—Operations Research Symposium, University Museum Lecture Hall, University of Pennsylvania, Philadelphia, Pa.

Feb. 7—Annual Mid-Winter Symposium of the New York Section, Instrument Society of America, Garden City Hotel, Long Island, N. Y.

Feb. 14-15—1957 Transistor and Solid State Circuits Conference, University of Pennsylvania, Philadelphia, Pa.

Feb. 26-28—Western Joint Computer Conference, sponsored by IRE, AIEE and ACM, Hotel Statler, Los Angeles, Calif.

Mar. 7-9—National Conference on Aviation Education, Hotel Mayflower, Washington.

Mar. 11-15—1957 Atomic Exposition, including Nuclear Engineering & Science Congress, 5th Atomic Energy in Industry Conference and 5th Hot Laboratories & Equipment Conference, Convention Hall, Philadelphia, Pa.

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Vol. 65, No. 25

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One in a series about users of Phillips 66 Aviation Products

Phillips 66 LOOKS AHEAD with TWA

New York to Los Angeles in 4¼ hours! That is the anticipated schedule for the new 707 Jet Stratoliners ordered by TWA for mid-1959 delivery. Shown below, the new plane will have a cruising speed of 575 miles per hour, and a range of 3500 miles.

Interior scenes shown below are from a mock up of the Boeing 707

ALL ABOARD *for new passenger comfort made even more pleasurable by gaily-colored interior paneling. Conditioned air system, hat racks, lavatories, all are designed for maximum convenience.*

NINETY-EIGHT PASSENGERS *can be seated in present mock up design. Lounge seats can be removed for 10 more passenger seats. Smoke tint plastic window shades can be pulled up for glare reduction.*

RELAXATION DE LUXE *in the modern new forward lounge. Wall panels, snap fastened, can be removed for maintenance and replacement in a short time and with a minimum of effort.*

Today, Phillips 66 Aviation Gasoline gives dependable, efficient performance to TWA and other leading air lines, as well as to the military air services.

In step with the future, Phillips is a leading producer of *super performance* Jet Fuels for the latest designs in turbo-props and jets. And Phillips research continues to lead the way for development of fuels for the aircraft of tomorrow.

AVIATION DIVISION • PHILLIPS PETROLEUM COMPANY • BARTLESVILLE, OKLAHOMA

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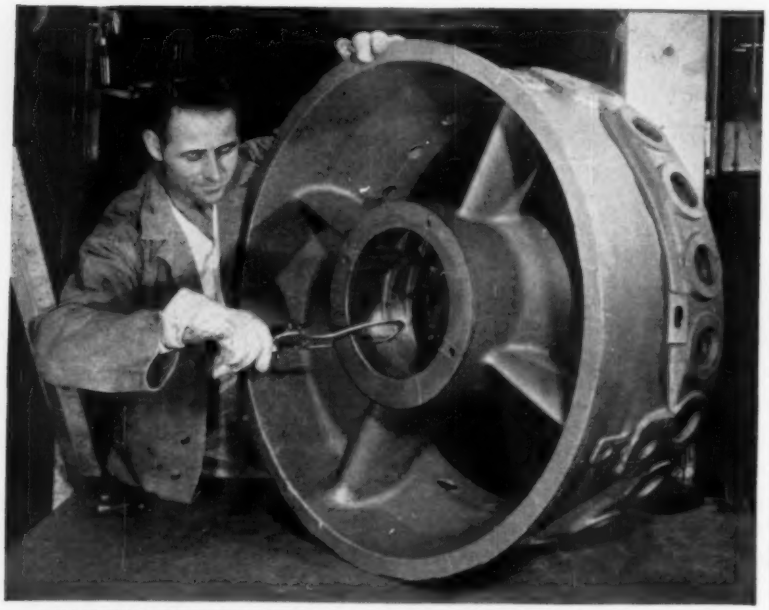

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DOW

Mar. 14-15—Flight Propulsion Meeting, (Classified), sponsored by IAS, Hotel Carter, Cleveland, Ohio.

Mar. 18-21—Pacific Coast Plastics Exposition, in conjunction with The Society for Plastics Industry National Conference, Shrine Exposition Hall, Los Angeles.

Mar. 18-21—National Convention, Institute of Radio Engineers, New York Coliseum and Hotel Waldorf-Astoria, New York, N. Y.

Mar. 19-21—151st National Meeting of the American Meteorological Society, University of Chicago.

Mar. 25-27—Silver Anniversary Technical Meeting and Convention, American Society of Tool Engineers, Shamrock Hilton Hotel, Houston, Tex.

Mar. 25-29—Western Metal Congress and Exposition, Ambassador Hotel and Pan-Pacific Auditorium, Los Angeles.

Mar. 27-29—Educational Colloquium on Radiation Effects on Materials, sponsored by ONR and Glenn L. Martin Co., Johns Hopkins University, Baltimore, Md.

Apr. 8-12—Fifth Welding & Allied Industry Exposition, Convention Hall and Hotel Sheraton, Philadelphia, Pa.

Apr. 16-18—Symposium on Nondestructive Tests in the Field of Nuclear Energy, Morrison Hotel, Chicago, Ill.

Apr. 17-20—Eighth Annual Conclave, Arnold Air Society, including aviation equipment display, Hotel New Yorker, New York, N. Y.

Apr. 24-25—Second National Industrial Research Conference, sponsored by Armour Research Foundation, Conrad Hilton Hotel, Chicago, Ill.

Apr. 29-May 3—Seventh National Materials Handling Exposition, Convention Hall, Philadelphia, Pa.

May 1-3—Spring Meeting and Exhibit, Society for Experimental Stress Analysis, Hotel Statler, Boston, Mass.

May 6-8—28th Annual Meeting, Aero Medical Assn., Shirley Savoy Hotel, Denver, Colo.

May 24-June 2—22nd Paris Air Show, Society of French Aircraft Constructors, Le Bourget Airport, Paris.

June 1-9—First Annual National Aviation Trade Show, Monmouth County (N. J.) Airport.

June 23-25—29th Annual Meeting, Aviation Distributors & Manufacturers Assn., The Broadmoor, Colorado Springs, Colo.

July 6-10—Eleventh All-Woman Transcontinental Air Race, sponsored by Ninety-Nines and Aero Club of Pennsylvania, from San Mateo County Airport, San Carlos, Calif, to N. Philadelphia Airport, Pa. For details write: Headquarters, AWTAR, 2611 E. Spring St., Long Beach 6, Calif.

Aug. 20-23—Western Electronic Show & Convention Board of Directors, Cow Palace, San Francisco, Calif.

Sept. 1-16—Sixth International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Folkestone and London, England.

Oct. 28-31—National Industrial Packaging & Handling Exposition, Convention Hall, Atlantic City, N. J.

Positive Identification

Collins 621A-1 ATC Transponder of Collins Airborne Electronic System

Instantly replying to the Interrogator of the Air Traffic Control surveillance radar, Collins 621A-1 reliably identifies you through all weather. Selection of up to 64 different reply codes are available to the pilot. Transmitted information will be displayed on ATC radar. The 621A-1 is contained in a ½ ATR case, modularized, weighs only 25 pounds. Receiver on 1030 mc and is crystal controlled to assure reception of interrogations. Transmitter frequency 1090 mc, stability ±3 mc. Equipment will be available for use in CAA evaluation of ATC Interrogator-Transponder System.

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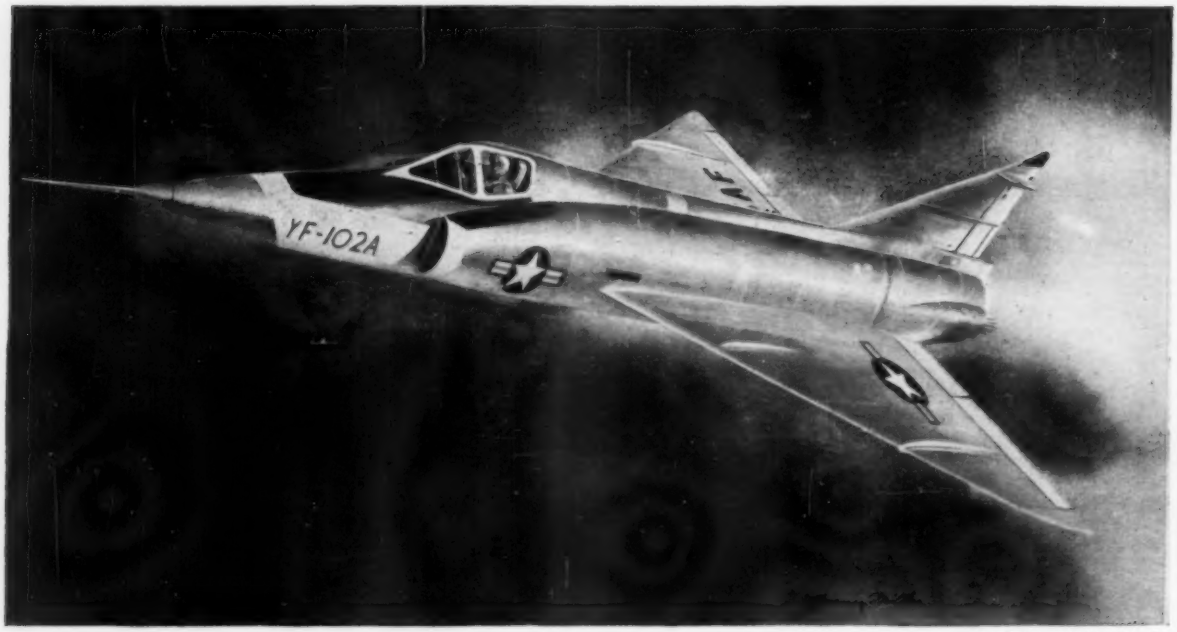
BURSTING THROUGH THE SOUND BARRIER...



U. S. A. F.—CONVAIR 102-A

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2 During straight and level flight, the precision cam must provide maximum fuel efficiency to assure the maximum range.
3 During combat, the complex surface of the three dimensional cam becomes the pilot's most sensitive assistant by automatically compensating for changes in pressure and temperature.
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The three dimensional cam, like the power control itself, is designed, engineered and manufactured by Holley—one of the world's foremost power control manufacturers.

Typical "brain center" of a Holley aircraft engine control. Note the delicate machined surfaces. Each plays a vital role in mechanically regulating the engine under varying conditions.

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• Hardness range, durometer	20 to 80

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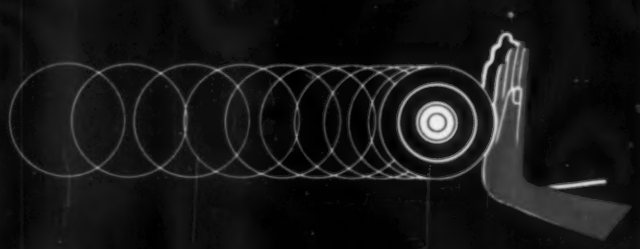

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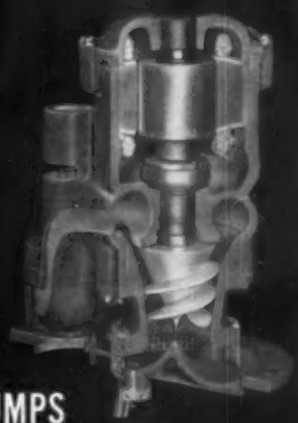

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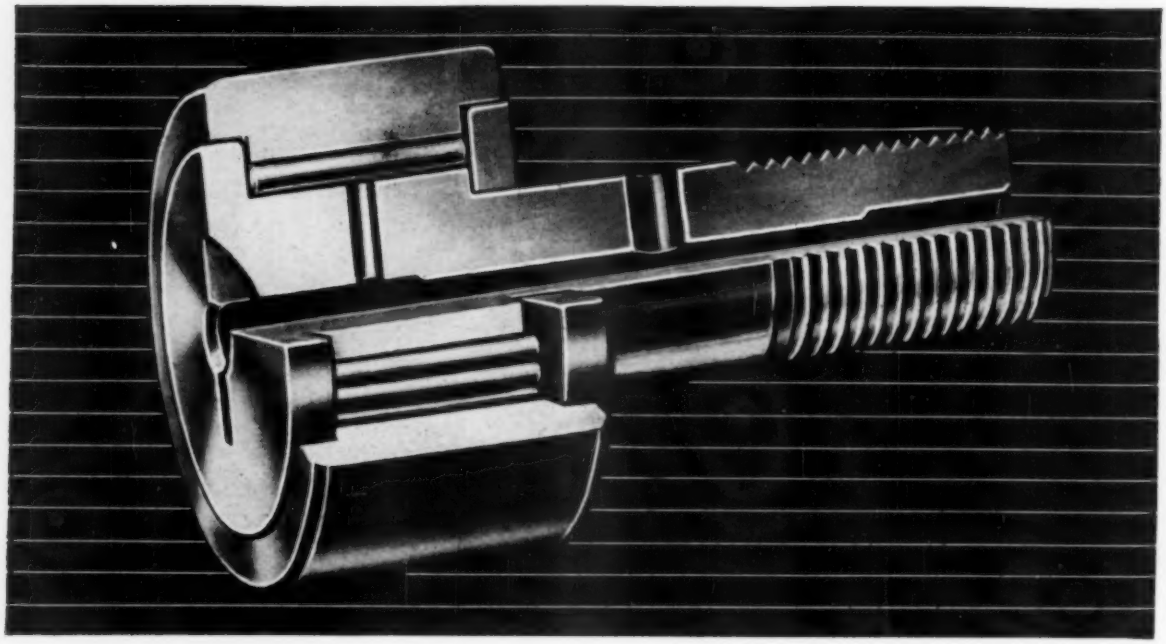

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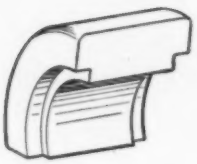

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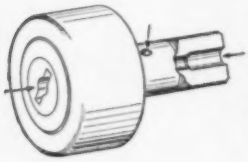
2. Integral stud for cantilever mounting is made of case hardened and ground low carbon nickel molybdenum steel. The tough core provides high strength to withstand high shock loads.



3. Easily relubricated at any one of three points—at either end or through cross hole in stud. Ends accommodate standard drive grease fittings, or may be sealed by the plugs provided.

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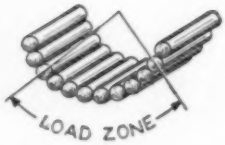
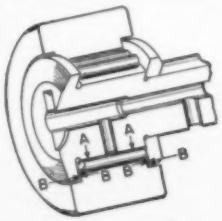
4. Full complement of small diameter rollers—through-hardened, ground and lapped—for maximum radial load capacity.





5. Raceways precision ground for even load distribution (A) and uniform low end play (B) assure long bearing life.

Torrington Cam Followers are precision made throughout. They are available in sizes from ½" to 2¼" O.D. Special surface finishes such as chrome and cadmium plate or oxide black can be provided.

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ELECTRO-SNAP H1-43

with a . . . LIGHTER, TOUGHER HERMETICALLY-SEALED RIBBED CASE!

PROTECTION is the key word. Switches for fast-flying, hot-landing aircraft need plenty of protection . . . and the H1-43 "Landing Gear Switch" exceeds requirements! *Three* "beefed-up" mounting lugs hold the switch rigidly and can take over-torquing without damage. Dry, inert gas is sealed inside . . . *permitting full electrical rating at any altitude!* And the entire case is made more rigid by ribs backing the closure plate.

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ELECTRO-SNAP SWITCH & MFG. CO.
4232 WEST LAKE STREET
CHICAGO 24, ILLINOIS

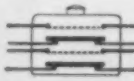
"LANDING GEAR SWITCH"

ELECTRO-SNAP H1-43

with these SPECIFICATIONS

Leak Rate	Less than 1 Micron/cu. ft./hr.
Actuator Arm Adjustment	14°±2°
Electrical Rating	
125/250 V a-c	15 Amps
30 V d-c (Resistive)	15 Amps
(Inductive)	10 Amps
With Adjustment Fully Closed	
Pretravel	0.100±0.031"
Movement Differential	0.062±0.025 —0.000"
Overtravel	0.281" Min.
Min. Mechanical Cycles	200,000
Min. Electrical Cycles	200,000
Operating Force	4 LB+2 —0
Overtravel Force	11 LB±3
Difference in Operating and Reset Point Between Each Pole	0.010" Max.
Ambient Temperature Range (Std.)	—100F to +250F
Higher Temp Models Available	
Weight	8 Ozs. Max.

CONTACT ARRANGEMENTS



Double-Pole Double-Throw 4 Circuit

ALSO AVAILABLE

Double-Pole Normally Closed

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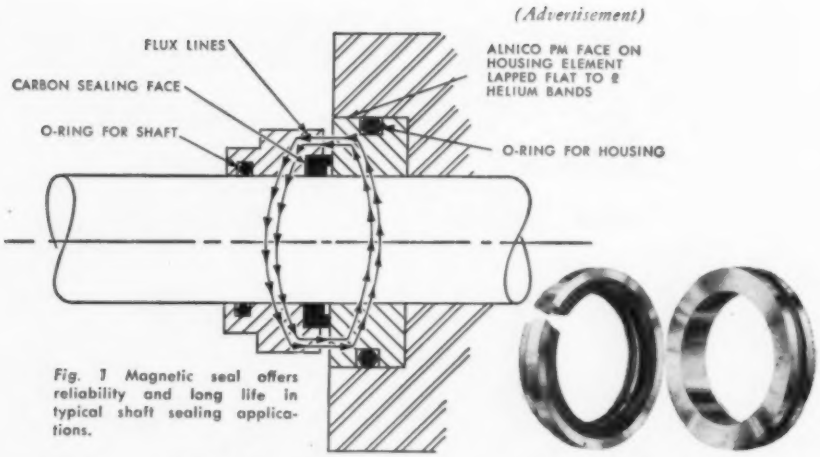
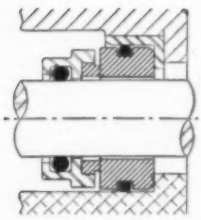
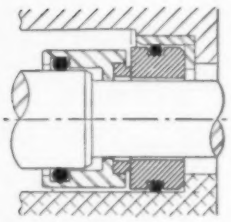

FLUX LINES
CARBON SEALING FACE
O-RING FOR SHAFT
ALNICO PM FACE ON HOUSING ELEMENT LAPPED FLAT TO 8 HELIUM BANDS
O-RING FOR HOUSING

Fig. 1 Magnetic seal offers reliability and long life in typical shaft sealing applications.



LOW PRESSURE MAGNETIC SEAL



HIGH PRESSURE MAGNETIC SEAL

Aircraft Shaft Sealing Problem Solved Through Magnetics

Force and wear are distributed evenly over entire face of new, effective, long-lasting magnetic shaft seal. Troublesome springs and packing are eliminated.

By Edward A. Steeves
Member, ASME

One of the most difficult problems in designing the powered elements of aircraft is sealing shafts against the loss of fluids, or their passage into areas where they may contaminate vital operating parts. A wide variety of fluids must be sealed: fuels, lubricants of various types, hydraulic fluid, and others, under severe operating conditions.

In addition, the customary factors of space and weight must be given full consideration.

By applying magnetics to this problem, designers have come up with an effective solution. The magnetic shaft seal takes minimum space because springs and packing are replaced by magnetic attraction between the shaft and housing elements of the seal. Force is distributed evenly throughout the metal, so wear is slow and even, and the seal *Fig. 1* performs reliably for much longer periods than spring-loaded and packed seals.

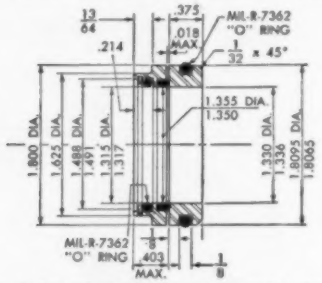


Fig. 2 Typical application of magnetic shaft seal in aircraft generator. Rotational speeds do not impair effectiveness of seal.

Operating Principle

New concept in shaft sealing for aircraft applications uses magnetic force to replace springs and screws to hold shaft and housing elements together.

A magnetized ring of Alnico V, with an O-ring gasket on its outer surface, is inserted in the housing. Another ring is mounted on the shaft and held firmly against the Alnico element by magnetic force. A carbon ring in the face of the shaft element contacts the lapped surface of the magnet and forms a permanent, self-adjusting face seal.

An O-ring mounted inside the shaft element prevents the confined fluid or gas from escaping along the shaft. The O-ring on the magnetic element keeps the fluid from leaking out the housing.

Advantages of Magnetic Shaft Seals

Reliable, effective sealing is characteristic of the magnetic shaft seal. One of the elements of the seal is permanent magnet, so the sealing force is "built-in". No springs or screws are required . . . the sealing force is evenly distributed over the faces of the seal. There's no face leakage initially, and the seal "wears in" over its entire life . . . in many cases longer than the life of the shaft.

It is more compact and lighter in weight than any conventional seal.

The carbon sealing face is self-lubricating — runs cool and wears slowly.

Typical Application of Magnetic Shaft Seal

Jack & Heintz, Inc., struck a serious sealing problem in an aircraft generator. Generator cooling oil could contaminate the brushes and cause generator failure unless the shaft were effectively sealed. Operating conditions called for a rotational speed of 12,000 rpm. Although the shaft measured 1.312 in. dia., only minimum axial space was available for the seal.

The solution was found in the magnetic shaft seal illustrated in *Fig. 2*. Effective, positive face sealing at high rotational speeds proved to be the ideal solution, yet the space required was held well within the design requirements. The result is reliable, effective seal, and clean generator brushes between overhaul periods.

Specifications of Generator Shaft Seal

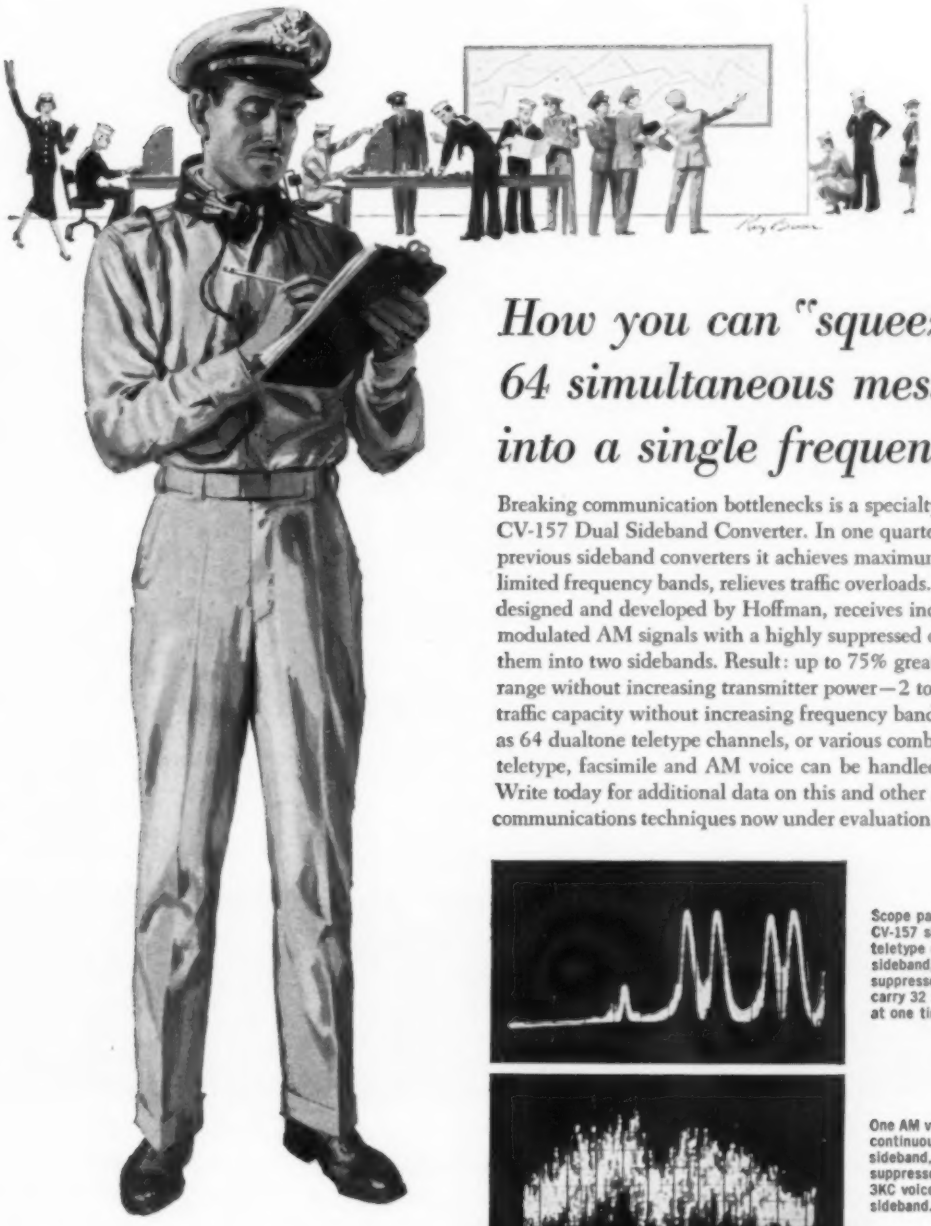
Fluid or Gas	Outside Air	Inside Lubricant MIL-L-7808
Pressure (max.)	15 psi	Variable
Temp. °F (max.)	300	——

Shaft Dia. (in.) 1.312
Material Steel

Additional Technical Information is Available

Send for our complete brochure on magnetic shaft seals.

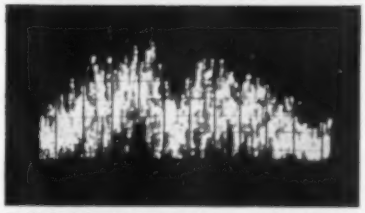
magnetic seal corp. — SOWAMS ROAD, BARRINGTON, R. I.



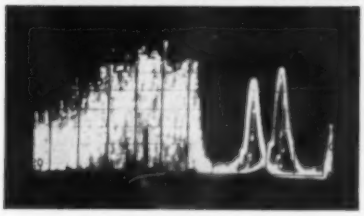
How you can "squeeze" 64 simultaneous messages into a single frequency

Breaking communication bottlenecks is a specialty of the Hoffman CV-157 Dual Sideband Converter. In one quarter the space of previous sideband converters it achieves maximum use of today's limited frequency bands, relieves traffic overloads. The CV-157, designed and developed by Hoffman, receives independently modulated AM signals with a highly suppressed carrier and splits them into two sidebands. Result: up to 75% greater effective range without increasing transmitter power—2 to 32 times more traffic capacity without increasing frequency bandwidths. As many as 64 dualtone teletype channels, or various combinations of teletype, facsimile and AM voice can be handled by the CV-157. Write today for additional data on this and other advanced communications techniques now under evaluation at Hoffman.

Scope pattern taken from Hoffman CV-157 showing two dualtone teletype channels on upper sideband, carrier partially suppressed. Each sideband can carry 32 teletype channels at one time.



One AM voice channel (made by continuous vowel sound) on each sideband, carrier completely suppressed. CV-157 carries two 3KC voice channels on each sideband.



AM voice on lower sideband, dualtone teletype channel on upper. With suitable multiplexing equipment, the CV-157 handles 64 simultaneous dualtone teletype channels.

ALL PHOTOS UNRETOUCHED FROM PANALYZOR MODEL SB-8

Electronics and Mechanical Engineers
Significant developments at Hoffman in the fields of VLF, HF, VHF, UHF, forward scatter and tropospheric communications, single sideband and advanced ECM techniques have created important positions for engineers of high calibre. Please address inquiries to Vice-President of Engineering.

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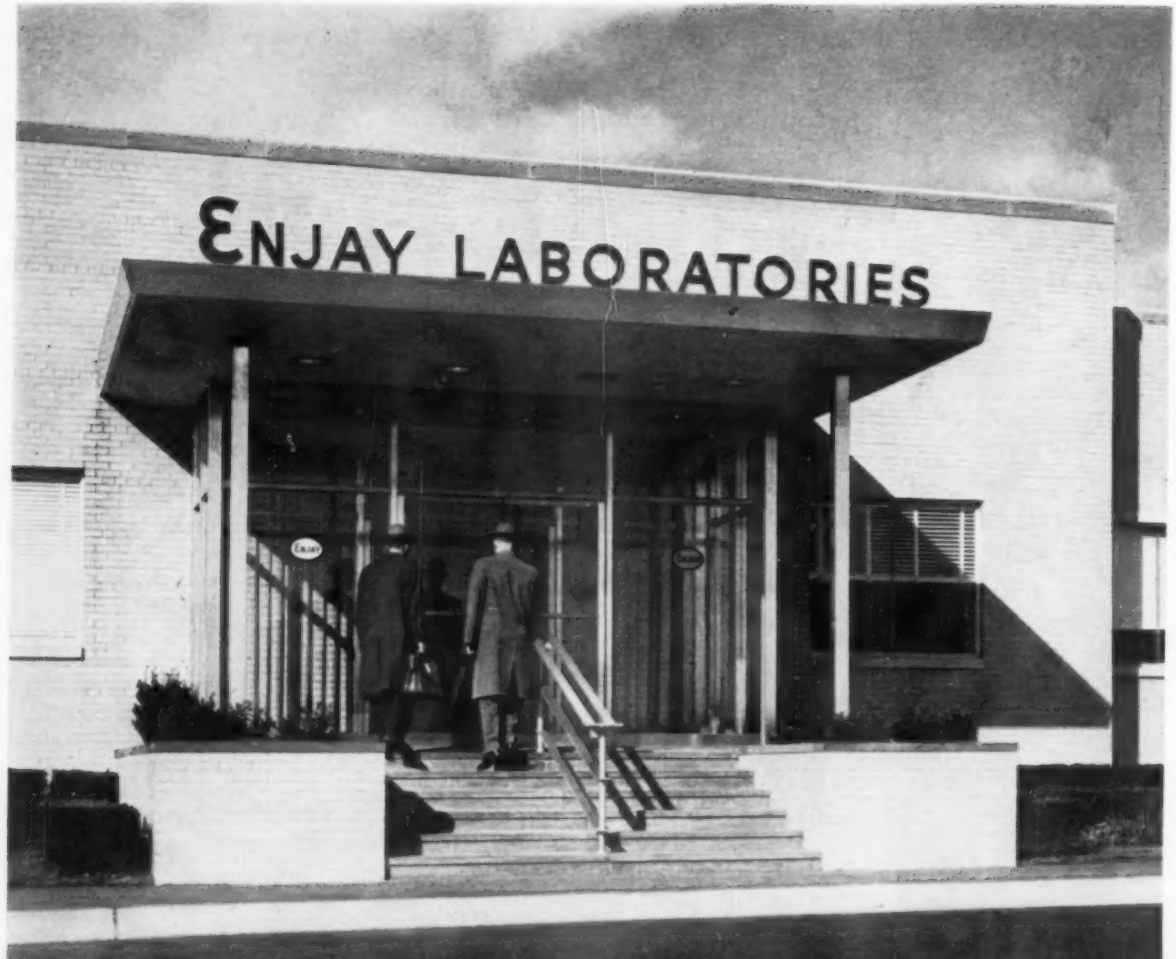

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DECEMBER 17, 1956

AVIATION WEEK

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Dim Future for National Air Show... 21

COVER: Area-ruled geometry and conical-cambered wings are two outstanding features of Convair's B-58 Hustler weapons system based on planform of Convair F-102A. B-58, a relatively small-sized airplane, has ability to carry a wide variety of weapons at supersonic dash speeds. Although production status is still uncertain, Convair has firm order from USAF for 13 airplanes, and probably commitments for more. For full story on B-58, plus exclusive pictures, see page 26.

Picture Credits:
37—Howard Levy.

67,912 copies of this issue printed

AVIATION WEEK • DECEMBER 17, 1956 • Vol. 65, No. 25
Member ABP and ABC

New fuel cell baffles 11,900 lb. surge pressure

When the spectacular Douglas F4D Skyray takes off from a Navy carrier, it blasts out and up at a record-setting pace.

Imagine the surge pressure set up in a longitudinal fuel cell by such a catapult take-off—or during an arrested carrier landing. It would be sudden and devastating—as much as 11,900 pounds of surge pressure that would burst a conventional fuel cell.

Obviously, this problem had to be solved before making test flights. Development engineers of the B. F. Goodrich Aviation Products division, called in by Douglas, worked out a solution.

They designed a cell containing a series of special baffles, dividing the interior into compartments. The baffles were reinforced with steel cables to soak up surge pressures and transmit them to the airframe. The resulting B. F. Goodrich fuel cell combined maximum strength with minimum weight. It is proving itself successful in every flight of a Skyray.

For the best solutions to your fuel cell problems, call upon experienced engineers of B. F. Goodrich Aviation Products.

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EDITORIAL

Dim Future for National Air Show

For more than three years, there has been a rising tide of skepticism in the aircraft industry and the military services over the wisdom of continuing the National Aircraft Show as the traditional annual showcase for military and civil aviation.

The National Aircraft Show has done a good job of promoting the cause of adequate airpower in its long history that goes back to the early 1920s when aviation was still staggering along in the spruce, doped fabric and baling wire era. The show has undergone a considerable metamorphosis since the pre-war era when formation acrobatics and closed course racing around pylons were the principal attraction. Post-war efforts to revive closed course racing never really succeeded despite a brief experience with midget racers and a vogue of war surplus hot rods. When closed course racing was attempted with jet fighter types, it was quickly apparent that this was too dangerous to be continued. We recall vividly the structural battering Lockheed F-80s and North American F-86As took in their low level flight, streaking around the pylon marked course at Cleveland in 1948 and 1949.

Since the advent of supersonic and high-altitude performance aircraft, the problem of adequately demonstrating military airpower for the public at low altitude has become increasingly difficult.

Lack of Purpose

In an editorial "Are Air Shows Necessary?" on Oct. 22 (p. 23) we noted that, of all the major international air shows, the National Air Show was most lacking in clarity of purpose and reported industry and military sentiment for changing emphasis in this aerial menu.

During the past few years, the National Aircraft Show has been held together by the substantial participation of the Defense Department contributing USAF, Navy, Army and Marine aircraft for the spectacle and of the aircraft industry paying substantial fees for static exhibits of its products. Last week, indications from both these sources of support indicated they probably cannot be counted on to continue their backing of the show.

Aircraft Industries Assn.'s Public Relations Advisory Committee, in making recommendations to AIA's board of governors, voiced serious doubts over effectiveness of the show in achieving industry objectives.

This AIA group listed the following major points of criticism:

- **Unanimous agreement that recent shows** have not been effective for industry objectives.
- **Sonic and supersonic aircraft** with high altitude performance make flight demonstrations "totally impractical."
- **Cost of industry exhibits is "excessively high"** and benefits are "negligible."
- **Display of newly developed aircraft** frequently results in interruption of production and testing programs, is costly and necessitates diversion of valuable production and engineering manpower.

USAF's attitude, as reported by our military editor, Claude Witze, is that its objectives can be better served by devoting its resources to expanded Armed Forces Day activities scattered at key locations throughout the country rather than by being concentrated in the area where the National Aircraft Show is playing its three-day stand.

What Does Future Hold?

Without full support from the aircraft industry and USAF, the National Aircraft Show can hardly hope to continue in its present form. If the Oklahoma City show last September proves to be the last, what will take the place of the National Aircraft Show?

Will an expanded, better planned and better executed series of Armed Forces Day displays do a better job of selling the role of airpower to the American people than a centralized three-day annual aerial carnival?

Does the aircraft industry need an annual display to sell its commercial products both at home and abroad similar to the British air show at Farnborough?

Can the aircraft industry and the military make a better pitch to the taxpaying public by using television as a substitute for the National Aircraft Show? An interesting audience comparison could be drawn between the 151,000 citizens who paid to see the Oklahoma City show and the millions of Americans who are watching the current Columbia Broadcasting System "Air Power" television series each Sunday night at home without cost. Individual firms in the aircraft industry have gotten enormous public coverage from documentary style films used as public service presentations on television.

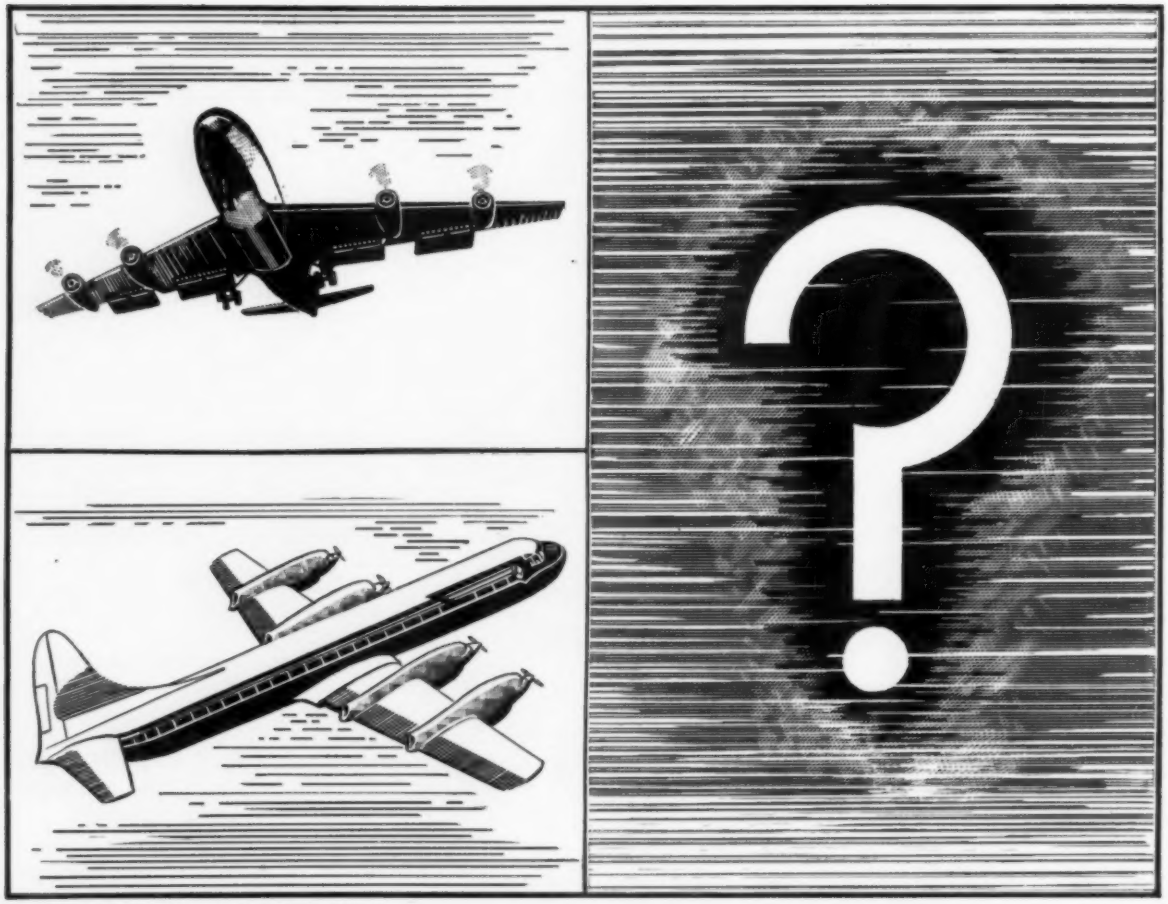
Public Relations Goals

We think a good healthy debate on the public relations goals of the aircraft industry and the military services and the measurement of the National Aircraft Show's effectiveness in achieving these goals will serve a useful purpose. Aviation is a field where a reluctance to change rapidly to meet new technical and social demands has spelled certain failure.

Military and commercial airpower need a continuous, effective public relations program if they are to grow sufficiently to discharge their responsibilities. For it is the taxpaying and ticket buying public that supports them both.

Tailoring such a program to effectively achieve its goals calls for serious, professional thought. It just can't be done by amateurs operating haphazardly.

—Robert Hotz



Top: BOEING "707" Bottom: LOCKHEED "ELECTRA"

who'll be next to use PNEUMATICS?

The new Boeing "707" and the new Lockheed "Electra" are both equipped with Kidde compressor-powered pneumatic systems. The reliability of Kidde designed and manufactured equipment, proved by thousands of systems in military aircraft, made Kidde pneumatics a natural choice of these forward looking manufacturers. Who will be next?

Designers and developers of lightweight, dependable pneumatic actuating systems, Kidde's creative engineering staff has refined pneumatics to an amazingly flexible state. Today, there is no job—aloft or on the ground—which pneumatics cannot do as well *or better* than existing aircraft actuating systems.

In addition to 4cfm and 2cfm compressors which are currently in production, Kidde also has a complete line of allied pneumatic equipment—pressure relief valves, dehydration equipment, lightweight steel or fiberglass high-pressure storage vessels. 6cfm, 8cfm, 12cfm and 25cfm compressors, some developing 5000 psi, are now in various stages nearing production.

At this moment, Kidde can furnish many items of pneumatic equipment on an off-the-shelf basis, and can furnish as well the engineering talent to develop special equipment on request. Consider the use of pneumatics in today's, or tomorrow's, aircraft. Why not discuss your pneumatic problems with Kidde?

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WHO'S WHERE

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D. J. Haughton, executive vice president of Lockheed Aircraft Corp., a director, Lockheed Aircraft Service, Inc., Ontario, Calif.

Harvey Gaylord, president, newly created Bell subsidiary, Bell Helicopter Corp., Fort Worth, Tex.

Edward Baruch, president and director, Heli-Coil Corp., Danbury, Conn.

H. S. Conrad, president, Stackpole Carbon Co., St. Marys, Pa. Also: **H. A. Williams,** general manager, Electronic Components Division.

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Lorian W. Willey, vice president, Air Associates, Inc., Teterboro, N. J.

Harry L. Jenter, vice president-operations, American Steel & Wire Division, United States Steel Corp., Cleveland, Ohio.

Honors and Elections

Dr. Wolfgang B. Klemperer, chief of the research section-missiles engineering, Douglas Aircraft Co., was presented a fellow award at the third annual meeting of the American Astronautical Society. Dr. Klemperer is a founder member and fellow of the Institute of Aeronautical Sciences.

Dr. Jordan J. Baruch, vice president and director-New Products Development of Bolt, Beranek and Newman, Inc., Cambridge, Mass., has been chosen the Most Outstanding Young Electrical Engineer of 1956 by a jury sponsored by Eta Kappa Nu Association, national electrical engineering honor society. **Robert B. Seidel,** president of Automatic Temperature Control Co., Philadelphia, Pa., was chosen to receive the honorable mention.

Charles Adler, Jr., Baltimore inventor, has been cited by the Civil Aeronautics Administration for his "generous act" in donating to the Government his patent for an aircraft collision warning device. James T. Pyle, acting CAA administrator, cited Mr. Adler's "patriotism" in giving up all royalties to his invention.

Firestone Tire & Rubber Co. has been elected to membership in the Rubber Manufacturers Association; **L. R. Jackson,** president, and **Raymond C. Firestone,** executive vice president, Firestone Tire & Rubber Co., have been named RMA directors. Also: **T. W. Miller, Jr.,** president, Faultless Rubber Co., named a director. **L. E. Spencer,** vice president of Goodyear Tire & Rubber Co. has been named to succeed **P. W. Litchfield,** chairman, Goodyear Tire & Rubber Co., who is resigning after more than 30 years as a RMA director.

INDUSTRY OBSERVER

► First test firing of North American Aviation's XSM-64 Navaho supersonic missile using a rocket booster and ramjet cruise powerplant combination ended in an explosion shortly after launching. Next Navaho launching is scheduled for early next year.

► **U. S. Weather Bureau hopes for a major breakthrough in long-range forecasting techniques as a result of an experiment planned for one of the Vanguard satellites during the spring of 1958. Experiment will measure the variation of the net incoming radiation striking the earth's atmosphere by using three spheres the size of ping pong balls mounted at the tip of one of the satellite's external antennas. Integration of the results will give the net energy distribution of the tropic area under the satellite orbit. The amount of energy hitting a five-degree strip of the earth has been estimated to be the equivalent of 100 million nominal-sized atomic bombs.**

► Northrop's T-38 twin-jet trainer now in the design stage is scheduled to be fitted with an afterburner version of General Electric's J85 lightweight turbojet engine. The new trainer will have a short takeoff run, low landing speed.

► **Budd Co., of Philadelphia, has perfected a resistance welded alternate for honeycomb in high temperature stainless steel structures. Formed by welding two stainless steel sheets to either side of a dimpled core, Budd claims it will withstand higher temperatures than brazed honeycomb, has the same strength and will allow between-the-skin cooling flow.**

► Army believes tests will show that the normal useful load of the Sikorsky H-37A will run close to 9,500 lb. Maximum useful load will be well in excess of 11,000 lb. The helicopter's empty weight is 19,704 lb., which brings it within the 20,000 lb. limit set for Army helicopters by Defense Secretary Wilson. Commercial version of the twin-engine aircraft is the S-56. Navy designation is HR2S-1.

► **Four Allison 501D13 turboprop engines will be fitted to a Super Constellation by Lockheed for an extensive flight test program before the powerplants are installed in the Lockheed Electra. The converted aircraft, scheduled to be in the air by next July, will be flown to simulate airline-type operations, including severe icing conditions.**

► Continental Army Command's Board 6 is monitoring development of Hughes Aircraft's 269 reconnaissance helicopter. Powered by a single engine, the helicopter will carry a pilot and observer.

► **Australian government is placing locally-produced Sabre-Avon jet fighters on the export market with promised deliveries beginning in late 1957. Possible purchasers include New Zealand and Israel.**

► Hiller's H-23D reconnaissance helicopter will be delivered to the Army sometime late next year. The three-place aircraft will have a new transmission designed to operate 1,000 hr. between overhauls.

► **Lockheed Aircraft has established a special project for development of a new early-warning Super Constellation aircraft scheduled to succeed the 1049A radar planes now on patrol service. The aircraft will feature the saucer-shaped radome already being test flown as an experimental installation on a Lockheed WV-2E. Project number for new aircraft is CL-257.**

► Sikorsky H-34A, Army version of the S-58, has completed tests in temperatures ranging up to 65 degrees below zero in the climatic hangar at Eglin AFB, Fla. A report on the results is now being prepared.

► **Swiss government decided to equip its air force with Dassault Mystere 4A interceptors to replace present British jet craft. Swiss Federal Council asked Parliament for $23 million in order to purchase the initial order of 40 Mysteres during 1957. Swiss government stated that Mysteres "are the jet planes at present best suited to serve Swiss conditions." Up to now Swiss have been equipped with British planes, mainly Vampire and Venom. These will be phased out by 1959.**

Season's Greetings

GM GENERAL MOTORS

NEW DEPARTURE
BALL BEARINGS

NOTHING ROLLS LIKE A BALL

Washington Roundup

Passing the Ulcer

Aircraft industry conviction that much of the real responsibility for suppression of information lies in the White House, and at the lower levels of government, has been strengthened by these two recent examples:

• **President Eisenhower,** sitting with Defense Secretary Wilson and others in a room over the pro shop at the Augusta National Golf Club just before a session on the Fiscal 1958 defense budget, told Wilson that "leakage" of information on defense spending and military manpower plans "is something that's got to stop." One reporter noted that Eisenhower spoke "with a clear show of irritation." Wilson said later that he and the President had not discussed the leak-stopping matter any further. "I wouldn't bother the President about that," Wilson said. "He would think that is my job."

Along this same line is the following story, which Wilson's Assistant Secretary for Legislative and Public Affairs, Robert Tripp Ross, tells.

• **In a discussion of why Defense Department** restricts so much information, particularly in the scientific and technical fields, Ross said one reason is that "the man upstairs"—meaning Wilson—"gets ulcers when he sees this information in technical publications." Ross said Wilson tells him: "This is giving me ulcers, worrying about this information getting out. The reason it is giving me ulcers is that the man in the White House sees something in the technical publications, and its giving him ulcers—so he calls me, and I'm passing the ulcers on to you."

The obvious implication is that the ulcers are passed down the line to the last man, who has a simple method for avoiding stomach trouble, too. He stamps everything "secret."

Dwindling of TAC

Watch for USAF's Tactical Air Command to be gradually absorbed into the Strategic Air Command. Long-range atomic capability of TAC fighter types has pressured a move to put them into the SAC striking force where all USAF atomic capability can operate under a single command. Also, budgetary pressure is making it attractive to eliminate all of the TAC overhead and toss a major portion of its former close-support mission to the Army's short-range missile forces. Unresolved problem in making the shift is who gets TAC's substantial troop carrier operation.

The Shrouded Budget

The almost unparalleled blanket of secrecy now covering Pentagon budget discussions and attributed to the White House probably stems from the President's knowledge that each branch of the armed forces is unhappy over its proposed share and that a real fight will break open on Capitol Hill if they are not placated before hearings begin next year.

Defense Secretary Charles Wilson already has indicated that he anticipates a rise in the total budget of from $36 billion to about $38 billion. This was before the Suez crisis but after Wilson knew that the Army, Navy and Air Force estimated they would need a total of more than $48 billion in Fiscal 1958. USAF, which received $16.5 billion in Fiscal 1957, probably will have another fight with the Army if it hopes to get at least as much as $20 billion in the new budget. With the Symington Committee still viewing the airpower question as unfinished business, this battle could develop into a major issue with serious political implications.

For the time being at least, USAF has decided to slow down its nuclear propulsion projects (AW Nov. 19, p. 27). This is only partially due to the administration's efforts to save money; the Air Force is also alarmed at the investment it would have to make to utilize the new weapon system. Meanwhile, with Wilson's blessing, research and development will continue to emphasize ballistic missiles, while hardware for inventory will go primarily into strategic and air defense arsenals. Wilson's attitude on research and development still remains cool, and there is no evidence that he has approved the expenditure of even the extra $100 million thrust upon him for this work by the last Congress.

Shift in Targets

Bertram B. Saymon, the man who has monitored House Information Subcommittee hearings for public information officials in the Defense Department, has been moved to a new spot in an apparent effort to parry the subcommittee's thrusts.

Saymon, who has briefed some Defense witnesses called before the subcommittee, formerly held the title of director of the logistics, property and international legislation division in the office of Robert Tripp Ross, Assistant Secretary of Defense for Legislative and Public Affairs. His new title is special assistant to Ross' deputy assistant secretary, Philip K. Allen.

The subcommittee, headed by Rep. John E. Moss (D.-Calif.), is not satisfied with the answers Ross and his aides have given this far on the Defense Department's restriction of information and plans further hearings.

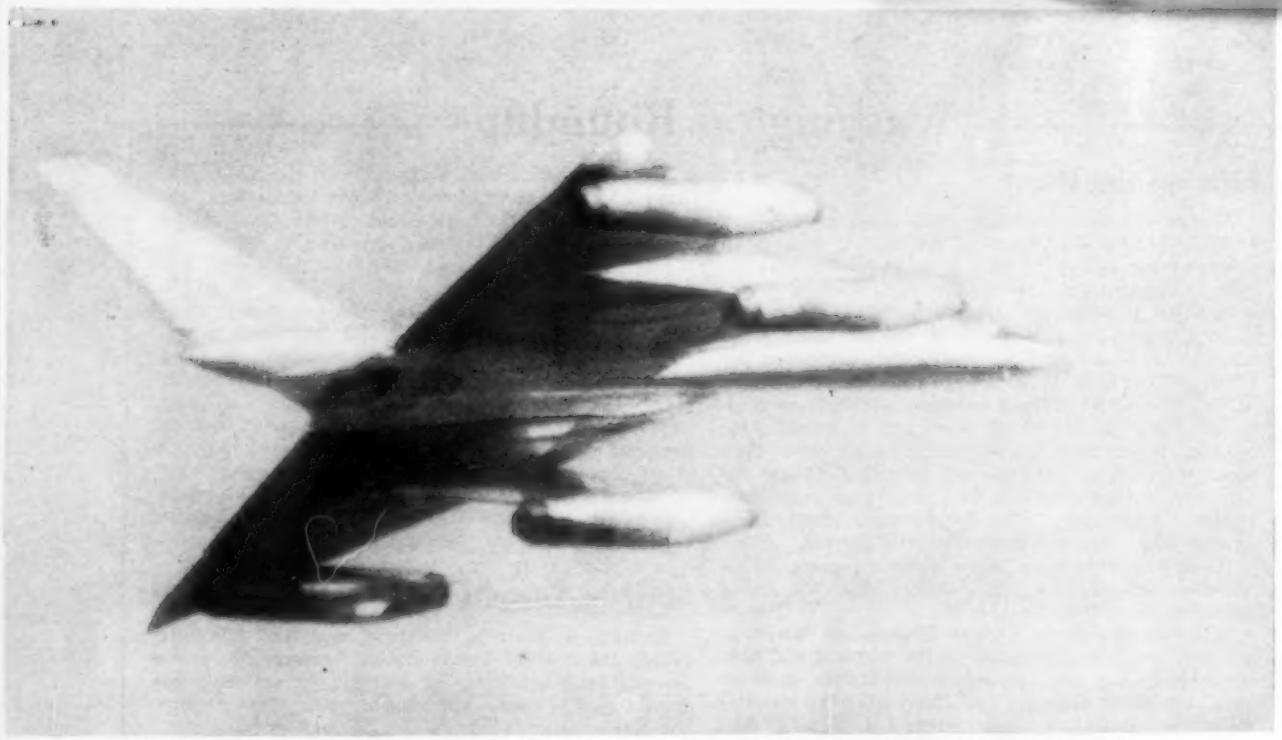
Donald B. McCammond, a Moss subcommittee target in earlier hearings, has resigned as special assistant to Ross to take a public relations job in industry. He came under fire from top military and civilian officials in the services for his editing and censorship of proposed speeches. Peter T. Chew, 32, who is replacing McCammond, comes from the public relations division of the Republican National Committee and has a background of newspaper and magazine writing and editing.

Local Carriers Win Round

The campaign by local service airlines for higher profits in their subsidy rates has borne fruit. The Civil Aeronautics Board has decided to investigate the situation and will review the rate of return level for the local airlines' mail rates and determine whether there should be a new policy on earnings.

The Conference of Local Airlines and the individual carriers have been working hard to sell the idea that they need higher earnings before they can improve their subsidy position. The feeder lines are currently costing the government $27 million a year in subsidy, and there is no improvement in sight.

While the local airlines have presented their case to the Board three times in the past year, they also were prepared to take the issue to Congress. Now, the CAB will conduct a formal investigation confined to the specific issue of rate of return for local service carriers, and the airlines will have a chance to make a record that will justify a change in policy. **—Washington staff**



CONICAL camber of B-58 Hustler is shown at left wingtip; aerodynamic feature reduces induced drag during cruise.

B-58 Hustler Packs a Big Punch in a S

By David A. Anderton

Convair B-58 Hustler weapons system is a little airplane designed to perform big missions.

Into its minimum-sized airframe Convair designers have packed the ability to carry a wide variety of external pods crammed with offensive or defensive weapons at supersonic dash speeds over the target area. Its four General Electric J79 turbojets have thrust it through Mach 1 without cutting in the afterburners.

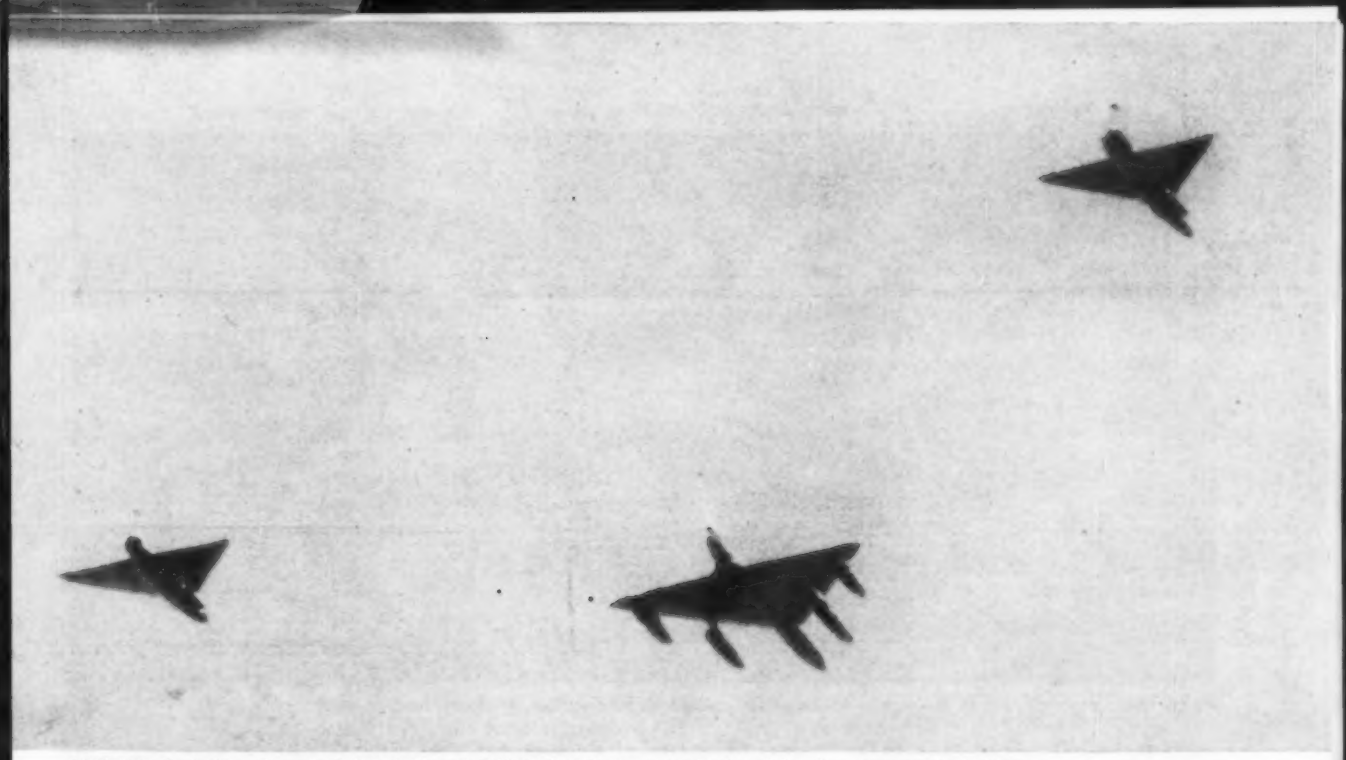
It has outrun—at less than full power—an F-100 chase plane which has a speed capability of about Mach. 1.4.

These first exclusive photographs of the B-58 show many of its design features including:

- **Area-ruled geometry** which reduces transonic wave drag and makes the "sonic wall" a low hurdle.
- **Conical-cambered wings** which reduce induced drag at cruising speeds without compromising supersonic dash performance.
- **Aerodynamic layout** based on the planform of the Convair F-102A, scaled up by a factor of 1.4 to double the F-102A's wing area.
- **High landing gear** to give clearance between the podded engines and the ground on takeoff and landings at the usual high angles of attack.
- **Podded powerplants** with supersonic inclined-shock inlets that take on board all the air needed to feed the J79 engines and to cool and pressurize the entire airplane and its systems.

First flight of the Hustler was Nov. 11, a little less than four years after the basic USAF decision was made to go ahead with the bomber. Production status of the Hustler, which has oscillated in an on-again, off-again condition for several years, is still uncertain. Convair has a firm order for 13 airplanes,

HUSTLER takeoff for first flight at Convair plant, Ft. Worth, shows high bogie landing gear for ground clearance.



HUSTLER flanked by Convair F-102 (left) and F-102A (right) shows small size of bomber compared to fighters.

a Small Frame

and undoubtedly commitments for more.

The Hustler project was debated at Air Staff level for nearly a year before it was given high priority early in May 1954. It was also early in May 1954 that the first of the Russian long-range bombers, the four-jet Bison, made its public debut over Red Square.

Minimum Size

The Hustler is actually a small airplane; its wingspan is 55 ft., comparable to the Northrop F-89 Scorpion series. Geometrically similar to the Convair F-102 wing planform, the B-58's delta surface measures about 1,430 sq. ft. in area, just about double that of the F-102. Wing area compares to that of the Fairchild C-119.

Maximum length of the Hustler from its sharply-pointed nose to its towering swept tail is approximately 95 ft. The plane stands about 30 ft. high.

Standard crew is three: a pilot, a navigator-bombardier and a defensive systems operator.

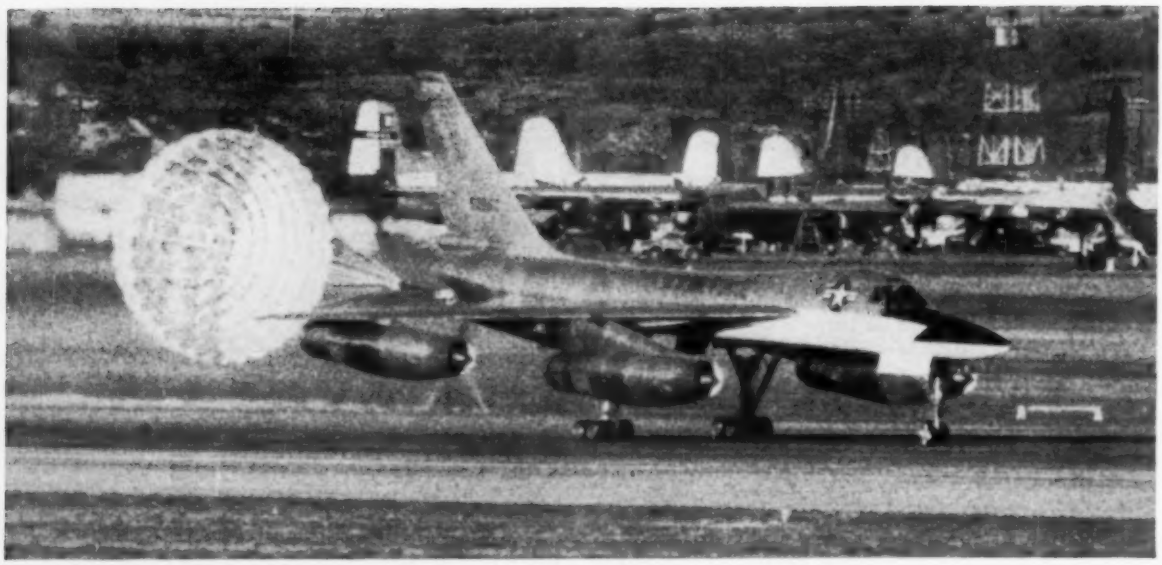
Powerplants for the Hustler are four General Electric J79 turbojets, rated above 12,000 lb. thrust each under sea level static conditions. This thrust, although reduced at altitude due to the lower air density, could be increased to values between 14,000 and 18,000 lb. per engine, using the afterburner fitted.

The Hustler, at least the portion of it shown in these pictures, is a weapons carrier. It is primarily an airframe with fuel and crew built around a series of external pods that carry complete bomber-defense systems, missile systems, photo-reconnaissance systems and others.

These pods have to have two fairly obvious characteristics: they must fit in the envelope defined by the nose gear and main gear, and they must not compromise the aerodynamic performance obtained through use of the area rule.

Dimensionally, these pods could be up to about 50 ft. long and about eight feet wide as absolute maxima. A pod using these dimensions would probably violate the area rule distribution, which

NACELLES for podded GE J79 turbojets look huge compared to fuselage size, are about 23 ft. long.



DRAG chute deployed, the B-58 slows to a halt at the end of its landing run following the first flight.

might be acceptable for a jettisonable weapon system.

But for a weapon system that had to be carried to the target area and back again as a pod, the shape would probably have a high fineness ratio and would be an aerodynamic blister on the belly.

That kind of a pod could only be about 30 ft. long and would have to be narrower than the 5.5-ft. fuselage width.

Four of the first batch of B-58s will carry electronic countermeasures systems being developed by the Waltham Laboratories of the Sylvania Electric Corp. The photo-reconnaissance system is being developed by the Fairchild Camera and Instrument Corp.

Airframe Design

The aerodynamic layout of the Hustler has undergone a couple of major changes since its original concept. First was the area-ruling of the layout, prompted when the Convair F-102 looked like it was doomed to stab at, but never pierce, Mach 1. The podded engines, originally paired in large flat nacelles, were divided into four separate packages as one result of this aerodynamic redesign. Another change produced the concavity of the fuselage rear deck visible in the ground pictures of the B-58.

The area removed here represented the cross-section of the wing.

Second major change in the layout was the incorporation of conical camber (AW Nov. 26, p. 26) to reduce the drag due to lift during the subsonic cruise portion of the mission. Used in its fully developed form on the B-58, conical camber also has been incorporated as a fix on the F-102A.

Controls on the B-58 are like those of the F-102. Elevons at the wing trailing edge control the airplane in roll and pitch. Small trimmers are located inboard on the trailing edges. A swept tail provides stability and control in yaw.

Simulated Hustler

The B-58 was "flown" long before it ever was built.

This was done in two airplanes which were rigged to simulate the responses and other dynamic characteristics of the bomber.

Cornell Aeronautical Laboratory modified a Lockheed F-94 so that it handled like the B-58. It was flown by B. A. Erickson, Convair chief test pilot and manager of flight for the Ft. Worth plant who made the initial flight and subsequent flights of the real thing. John C. Seal, Cornell test pilot, made the proving flights before checking out Erickson in the F-94.

At Convair, a Northrop F-89 Scorpion was modified to flight-test the B-58 control system. Its responses enabled Convair engineers to evaluate the power-control system of the Hustler long before they could have otherwise.

Highly-Swept Pylons

The four podded J79 powerplants are placed carefully on the B-58 in individual nacelles located to conform to area rule practice. The inboard nacelles are mounted on highly-swept pylons that place most of the engine ahead of the wing leading edge. The outboard engines are flush mounted to the under surface of the wing with the exhaust nozzle lined up with the wing trailing edge.

Maximum width of the egg-shaped nacelles is about 42 in.; overall length of the nacelles is about 23 ft.

There were three basic design considerations for the B-58 powerplants (AW June 4, p. 50):

- **Variable inlet** geometry automatically controlled to maintain maximum efficiency of the intake system throughout the mission profile.
- **Separate air sub-system** to handle and distribute the cooling and pressurizing air needed for the airplane and its weapons.
- **Systems analysis** of the thermodynamics to get a total picture of heat losses and gains throughout the entire airplane.

Nacelle inlets have a central spike to force an inclined shock at supersonic speeds. For maximum efficiency, the central spike should be moved so that the diagonal shock impinges on the cowl lip.

Structure

All the air necessary to feed the engine and to cool or pressurize the airplane comes in through the single inlet; there are no sub-systems inlets anywhere to dirty the airplane.

Metal-bonded primary structure is used extensively in the B-58, making up perhaps 1,000-1,200 sq. ft. of the plane's external surface. Most of this structure is stainless-steel sandwich; it forms the rear nacelles, the struts, underwing area panels, ailerons and the rear fuselage panels near the "hot" zone of the inboard engine.

Some of the structural components are being built for Convair by Ryan Aeronautical Co., under a contract for more than $500,000.

Landing gear of the Hustler seems abnormally high at first glance. But a

closer study shows that it is necessary, primarily because of a number of factors.

First, there is the high angle of attack that a delta-winged airplane takes during takeoff and landing. On the Convair F-102, the landing gear is near the rear of the fuselage, so that a large angle of attack won't rub the tail on the runway. But the B-58 gear is located almost midway on the 95-ft. fuselage, and that 40-ft. overhang could get very close to the runway if the gear were lower.

Second, the inboard nacelles clear the ground by less than four feet, judging by the pictures, and the outboard nacelle, although higher, would be closer as the angle of attack increases.

Third, there is always the possibility that an aerodynamically dirty pod would be acceptable for certain missions. Such a pod would require extra ground clearance.

Each main gear of the B-58 has eight tires of only 22-in. diameter, weighing only 18 lb. each. They feature a wide flat tread, and the General Tire and Rubber Co., who developed them, says they carry more weight per pound of tire than any other developed in the history of the rubber industry.

The main gear retracts into rectangular doors in the wing. Size and layout of the gear indicates that the main leg breaks, and rotating about both its attachment point in the wing and the axle of the bogie gear, retracts almost vertically.

There are 16 major operational functional systems in the Hustler, which are all designed to operate almost automatically with a minimum of supervision.

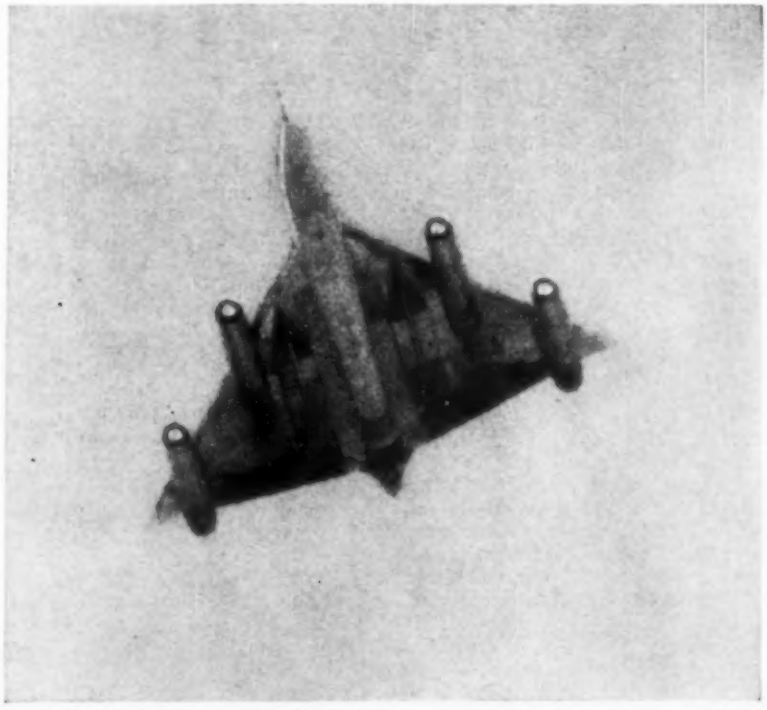
These are separate from the weapons systems carried and include:

- **Defensive measures,** developed by Sylvania for the detection equipment and Emerson Electric for the armament.
- **The bombing and navigation** systems were developed by Sperry Gyroscope Corp.
- **Air conditioning** and pressurization, developed by Hamilton Standard Division of United Aircraft Corp. This system controls heating, pressurizing and dehumidification of the cabin air, defogs the windshield, removes rain with an airblast and cools the crew, all the avionic gear and the wheel wells.

Trane Co. heat exchangers, weighing only 10 lb. each, are used during certain types of missions for extra cooling capacity

- **Autopilot and control,** developed by Bendix Aviation. The system uses a transistorized autopilot developed by the Eclipse-Pioneer Division.
- **Electrical power,** developed by the Small Motors Division of the Westinghouse Electric Corp.

Other specific contributions to the Hustler program have been made by Minneapolis-Honeywell who developed a transistorized fuel gage, and the Aro Equipment Corp., who developed the oxygen-air regulators.



GEAR UP, Hustler banks away after takeoff on second flight Nov. 14 at Ft. Worth.

Gaylord Will Head Bell Helicopter Corp.

Buffalo, N. Y.—Harvey Gaylord, general manager of Bell Aircraft Corp.'s Texas Division at Ft. Worth, Tex., will become president of the Bell Helicopter Corp. when the division reaches corporate status on Jan. 1.

Gaylord will continue as a director and vice president of the parent corporation.

The new subsidiary will have five vice presidents—Edwin J. Ducayet, Bartram Kelley, G. B. Clark, Roy H. Coleman and William G. Gisel. Gisel also will be secretary, and James F. Atkins will be treasurer.

Directors will include Leston Faneuf, president of Bell Aircraft and chairman of the new board; Gaylord, Gisel, J. Frederick Schoellkopf, Albert Fink Milton, E. Sherrard Elliot, Jr., and Frederick F. Robinson.

SAC, ADC Assume Northeast Duties

Washington—Responsibilities of the Northeast Air Command will be divided between the Strategic Air Command and Air Defense Command sometime after Jan. 1 as part of Defense Department's plan to simplify and strengthen the nation's defense structure.

No major change in deployment of forces in the NEAC area, which has headquarters at Pepperrell AFB, Newfoundland, is contemplated. The Air Defense Command will be responsible for planning and logistic support in the eastern region of the Distant Early Warning (DEW) Line, and any similar responsibilities which might grow out of future early warning programs.

Navy Orders More Grumman Traders

Navy has ordered an additional $24 million worth of Grumman TF-1 Traders.

Delivery schedule calls for three of the cargo-passenger airplanes per month, starting in November 1957.

These TF-1s will join others of this type in the Fleet Logistic Air Wings as carrier re-supply aircraft, ferrying passengers and cargo between carrier and shore.

To offset the tremendous strain that is caused by arrested carrier landings, the Traders are equipped with "cargo cages" instead of tiedown lines. A combination of movable bulkheads and steel bars, the cage will contain a 20-G load.

AIA, USAF Decisions Threaten Future of National Aircraft Show

Washington—National Aircraft Show faces a dim future.

Public Relations Advisory Committee of the Aircraft Industries Assn. has, for the first time, taken a firm stand against the show, terming it a high-cost vehicle for industry with negligible benefits.

Combined with a reversal in Air Force policy instituted by Secretary Donald A. Quarles, the action is expected to result in the withdrawal of Defense Department support from the annual Labor Day production. Quarles is opposed to further USAF participation.

PRAC Resolution

A resolution adopted by the Public Relations Advisory Committee continues its past recommendation that the AIA withhold sponsorship and financial support, leaving the question of participation up to the individual member company.

In addition, however, the committee has made these observations about the show:

- **There are widely differing opinions** about the show's effectiveness and value.
- **There is unanimous agreement** that recent shows have not served effectively for industry objectives.
- **Sonic and supersonic aircraft** with high altitude performance make flight demonstrations "totally impractical."
- **Cost of industry exhibits** "is excessively high as benefits are negligible."
- **Display of newly developed aircraft** frequently results in interruption of production and testing programs, is costly and necessitates diversion of valuable production and engineering manpower.

Why the Decline

Actual decline of the National Air Show, underwritten by the Air Foundation of Cleveland, Ohio, probably started with the end of closed course racing in 1949. From that point on, the Defense Department—led, for the most part, by USAF—has taken over an increasing portion of the flying show.

The official attitude was that the show constituted a report to the taxpayers. In the last few years, Army Aviation has taken part with enthusiasm as part of that service's effort to sell its fast-growing air program. The Navy traditionally has been a reluctant participant, going along solely to keep its flying lights from being darkened by USAF.

At the 1956 show in Oklahoma City, there was no flying demonstration of commercial aircraft of any kind for the first time. The show was an exhibition only of military capabilities (AW Sept. 10, p. 31). Attendance went down to 151,293, a sharp drop from the 1955 Philadelphia crowd of 289,880 for the three-day stand.

Interservice Rivalry

The Defense Department, eager to keep emphasis away from interservice rivalries, was upset by the 1956 program.

Navy used the show to point up the fact that carrier-launched planes can reach targets more than 2,500 mi. inland.

USAF demonstrated that its B-47 can fly non-stop from points in North Africa and England and added a long-distance speed record by the F-100.

The Army proved that helicopters have commendable endurance with a new record of approximately 58 hrs.

The Pentagon decision on future participation is up to a committee on which the armed forces are represented. It was clear last week that the AIA committee, asked annually for an opinion, has detailed its indictment of the show in order to guide the Pentagon group in making its decision. This and the attitude of Quarles appeared certain to result in Defense Department withdrawal.

Criticism of the event, aside from the safety problems—which were, for the most part, abolished with the end of closed-course racing—has been mounting steadily since the shows at Dayton, Ohio, in 1953 and 1954.

More than two years ago, it was suggested that the Defense Department would get more effective publicity from a stronger effort on Armed Forces Day. It also was proposed that industry might benefit more by sponsoring an annual national television program to report on the year's technological and military progress.

Some consideration is still being given these programs.

French Cite Atomic Weakness

Paris—Recent National Assembly debate on the 1957 budget brought out bitter complaint over the French lack of atomic weapons. Many of the deputies pointed to the Russian threats during the Suez campaign as "atomic blackmail."

As one deputy put it: "Recent events have demonstrated that only those nations possessing atomic weapons will be able to make their voices heard."

Included in the French air force budget is an item of $150 million for studies and the building of prototypes. Of this amount, $40 million is earmarked for guided missile work.

Air Force Secretary Henry LaForest defended his budget against its critics. While admitting that the number of combat squadrons was below target goals and that no increase was expected, he pointed out that during 1957 French squadrons will be taking initial deliveries of Super Mysteres and the Vautour in an all-weather fighter version as well as a bomber version.

Thus, LaForest argued, efficiency in the air will improve during the year although numbers will not.

"I agree," LaForest said, "that this budget marks a pause in certain areas of our aerial equipment, but it creates no grave situation nor does it compromise the future of our aerial forces."

Despite this criticism, the government's 1957 air force budget of $817 million was upheld. It represents an increase of $55 million over 1956. The French military budget is based on the calendar year.

The government's critics were pushing for an air force budget of some $860 million. They pointed out in debate that 1957 air force funds represent only 28.6% of total military budget while U. S. Air Force funds amount to 46.3% of the American budget and the Royal Air Force funds made up close to 35% of the British military budget.

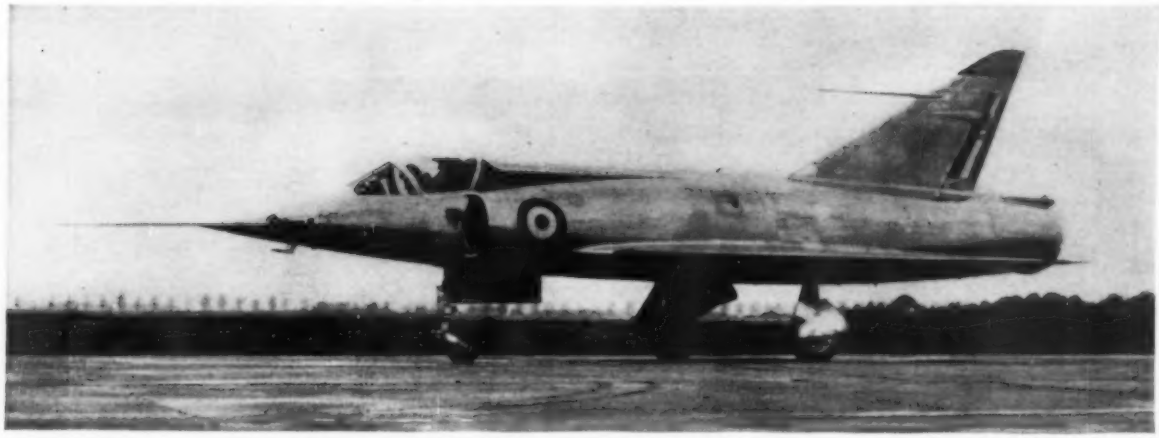
In all, the National Assembly voted a total military budget of $2,857,000,000, which included $817 million for air force, $880 million for army, and $537 for the navy.

Military credits to cover the special Algerian campaign, which is costing the government about a million dollars daily, as well as Suez campaign expenses, will be voted separately.

Deputy Louis Christiaens, former air force secretary, spoke in debate on behalf of the Assembly's National Defense Committee. He revealed that present French combat squadron strength is 40 instead of planned 51. This number, he said, isn't expected to increase during coming year nor would the air force be able to increase its present personnel strength of 146,000 men. Christiaens further complained that France by 1960 was slated to have 60 combat squadrons in operation but instead will have only 43.

These 43 squadrons, he said, will have only 724 combat aircraft at their disposal instead of the nearly 2,000 as called for in planning goals.

He also noted that by 1961 West Germany's goal calls for approximately 1,280 combat aircraft.



New Dassault Mirage

Dassault's Mirage III is a lightweight interceptor prototype with delta wing configuration powered by a Snecma Atar G engine with afterburner. Reported level flight top speed is Mach 1.5. Mirage exists in two other versions—Mirage I and II. These are powered by combination jet and rocket engines. Mirage III made its first flight Nov. 18.

Free Radical Research Spurred By New Three-Year Program

By Evert Clark

Washington—The major scientific assault against the problems of controlling free radicals of chemicals will be strengthened considerably by a three-year basic research program now being organized at the National Bureau of Standards.

Work with these high reactive, unstable atoms and molecules may have ramifications in rocket propulsion, solid-state physics, basic chemistry and a number of other areas.

Industrial research laboratories will be called upon to supply approximately half of the technical staff on a loan basis. One hope is that the research will be continued and expanded in many of the industrial laboratories after the bureau's program comes to an end.

Ambitious Program

Other investigators will come from universities and government agencies.

The exploration of free radicals, both directly and in connection with other investigations, has been carried out in a number of universities for several years, some of it under the sponsorship of the military services.

The ambitious bureau program is an attempt to provide an integrated approach to the problems of formation, properties and storage of free radicals. It is receiving Defense Department support and will be monitored by Army's Office of Ordnance Research.

A Free Radicals Research Section has been created at the Bureau of Standards, and, although the program is still largely in the planning stage, some projects are already under way. The section is headed by Dr. Herbert P. Broida, who has done extensive research in the field, both for the bureau and for the Air Force Office of Scientific Research.

Among the Bureau's plans for a coordinated attack on the problems is a "Symposium on the Formation and Stabilization of Free Radicals," now scheduled for next Sept. 18-20. Chairman of the executive committee is Dr. F. O. Rice of Catholic University, a pioneer in the field who is now making studies both for the Atomic Energy Commission and the Army.

Investigations now being sponsored by the services will not be affected directly by the bureau program, but a steering committee within the Defense Department will insure a two-way transfer of information on results.

Although the existence of free radicals has been known since about 1900, the first suggestion that controlled free radicals might have an application to rocket propulsion came in a proposal to the Air Force Office of Scientific Research from Dr. Fritz Zwicky, now a consultant to Aerojet-General Corp. (AW Dec. 3, p. 28).

Rocket-Fuel Study

USAF's Office of Scientific Research has contracts with Aerojet and Phillips Petroleum Corp. for direct investigation of the possibility. It also has contracts with 10 universities for exploratory investigations in physics and chemistry to acquire basic knowledge about free radicals and their role in natural phenomena. They are the University of Minnesota; Laval in Quebec, Canada; Washington University at St. Louis, Rensselaer Polytechnic Institute, Columbia, Washington, Maryland, Stanford, California and Boston University. The first AFOSR contract in this field dates back to 1952.

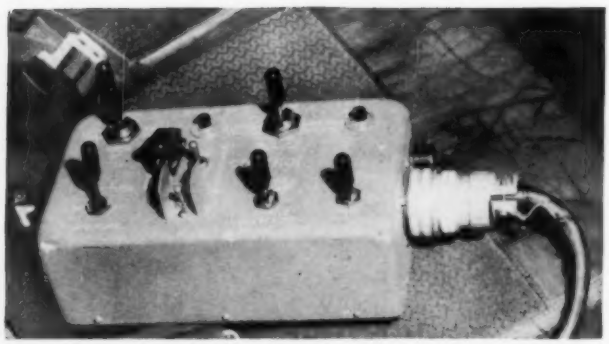
Significant Progress

Significant progress with free radicals in the past year led to the decision to make a concerted attack on the problems.

Advances included experiments by the Geophysics Research Directorate of USAF's Cambridge Research Center with the release of stored solar energy in the earth's atmosphere (AW Nov. 26, p. 32); work by Dr. Rice at Catholic University and by Dr. Broida at the Bureau of Standards; work by Dr. Chih Kung Jen and Dr. Samuel Froner at John Hopkins University's Applied Physics Laboratory, and work on an AFOSR contract which demonstrated on a laboratory scale that useful heat (and therefore thrust) can be obtained from a recombination unstable atoms.

Collier Trophy Awarded To Allen, Twining

Collier Trophy for the "greatest achievement in aviation in 1955" was awarded jointly to William M. Allen, president of Boeing Airplane Co., and General Nathan F. Twining, Air Force Chief of Staff. Allen and his associates were honored for "conception, development and quantity production of America's first all-jet, long-range bomber, the Boeing B-52." General Twining and the Air Force were cited for sponsoring and making the aircraft operational in 1955.



TEST PILOT Richard J. Followell (left) of Board No. 6, CONARC, operates ground control of QL-17 drone in vortice test. Followell controls takeoff and landing of drone, mother ship controls drone in air during experiment. Mother ship is a Beech L-23. Drone control box (above) is mounted in seat of L-23 aircraft.

Jet Vortices Present Light Plane Hazard

By Claude Witze

Eglin AFB, Fla.—U. S. Army and Air Force are probing the violence and duration of turbulence created by jet aircraft on takeoff in a series of experiments that may have a revolutionary effect upon air traffic controls.

Under the engineering direction of the Army Aviation Board at Ft. Rucker, Ala., a QL-17 drone is being flown at 110 mph. through the wingtip vortices of an F-100 fighter and B-47 medium jet bomber to determine the duration, characteristics and intensity of the turbulence. Climax of the tests being held here will involve subjection of the drone to sonic shock waves in flight.

In interceptions witnessed by Aviation Week, it was clear that, under proper conditions, the drone can be rolled as much as 50 or 60 deg. from its normal attitude when it hits vortices within four or five seconds after the generating aircraft has passed. At 1,000 ft., with an autopilot, the condition is quickly corrected. At low altitude, with a human pilot at the controls, the aircraft would be in danger of crashing.

Test Conditions

Operating at an altitude of 1,000 ft. in the still air of early morning, the USAF planes have been laying smoke trails through which the QL-17 drone is flown. The drone carries a 12-channel oscillograph to record changes in acceleration on three axes, roll, pitch, yaw, airspeed and altitude. No conclusions have yet been published, pending study of the recorded results.

Army's interest in this project, already the subject of research by the National Advisory Committee for Aeronautics and the Royal Aircraft Establishment of Great Britain (AW Jan. 16, p. 79), goes back to an accident in Canada early this year. At that time, a de Havilland Otter, taking off from an airport soon after a CF-100 jet fighter, was wrecked. Three men were killed.

The conclusion of the accident investigation was that vortices left by the jet fighter were violent enough to wrap

QL-17 DRONE landing at Eglin AFB after vortices test. Drone carries oscillograph to record attitude changes.

AERIAL view of control site shows drone, controller and Sikorsky H-34 used to transport control mechanism to test site.

the Otter's wings around the fuselage in mid-air. Later, a second Otter crash was attributed to a flap valve malfunction. Because of this, some discredit was cast upon the results of the first crash probe. It did serve, however, to spur interest in the vortice problem.

When Danger Is Greatest

Fundamental paradox already uncovered in experiments with the F-100 is that the wingtip vortex is most turbulent when the generating aircraft is in takeoff configuration. At relatively low airspeed, flaps down and in climb attitude, the spinning column of air is most severe.

As forward speed picks up, there is less danger of turbulence.

This phenomena has led to conflicting opinions among the experts on which design factor is most important in creating the condition. One school holds that the wing loading is crucial; another that gross wing area determines the amount of turbulence.

In the present experiments, the F-100 and B-47 were chosen to help solve this problem. Beech Aircraft Corp. has done some research on this aspect of the vortices as a threat to light aircraft and Beech engineers are cooperating with the Army in the Eglin tests. The Beech staff says a Bonanza broke up under strange circumstances in crossing the path of a B-47 flight.

F-100 Used

For the Eglin tests, the F-100 is flown by Capt. Roscoe Tanner of the Air Force Operational Test Center of the Air Proving Ground Command. He is attached to the 3243rd Test Group (Fighter).

Tanner's jet is equipped with six smoke tanks under the wings, each holding 12 two-minute grenades. He can lay a two-minute path with each tank.

Flying at 200 kt., wheels and flaps down, he lays his trail across the anticipated path of intersection. Earlier, the QL-17 drone, modified for the Army by Temco Aircraft Corp., is put into the air by a ground operator, then taken over for control by a mother plane, a Beech L-23. From this aircraft, the drone operator directs the intersecting plane into the smoke trail left by the F-100.

The drone's oscillograph can be turned on and off by the operator in the L-23. Interceptions are made at right angles to the vortices and at a 45 deg. angle. For a third test, the F-100 passes under the drone and cuts up sharply in front so that the QL-17 hits the turbulence while flying parallel to the vortices.

In this approach, it is possible to see that a marked longitudinal pitch in the plane occurs.

Helicopter Observation

In addition to the oscillograph record, visual observation of the intercept is made from a Hiller H-23 helicopter, which hovers about 1,000 ft. from the scene.

For safety, the drone is equipped for self destruction in case of mishap. It will dive into the ground if the mother plane loses control. In addition, the F-100 carries live ammunition and could shoot the plane down in an emergency.

In a theoretical formula devised by Beech engineers, the load imposed on the drone increases in direct proportion to the speed and lift generated by the F-100. A 90-deg. penetration of the vortices will increase the up and down loads. An angular penetration will duplicate this but add severe rolling moments.

The Eglin tests may prove the accuracy or inaccuracy of the Beech formula.

Some experts believe that such factors as temperature and humidity, as well as wind, may have an effect upon the severity of the vortices. None of these factors have been finally determined, so a small aircraft may go through the vortice safely, but small variations in the speed, elapsed time interval, altitude and other factors could result in critical loads on the intercepting aircraft.

Sonic Boom Tests

Beech engineers have estimated, for example, that a sonic boom generated 125 ft. under one of their light aircraft by a plane hitting Mach 1.5 would be critical for the tail and canopy. Pressure created by the boom would be in the neighborhood of 75 lb. per sq. ft. The Beech 95 Travel Air, for example, has a tail designed to take a load of 67.5 lb. per sq. ft. It is anticipated that results of the Eglin tests in this area will be classified, presumably because the phenomena could be used as a weapon.

Army's Aviation Board, headed by Col. Robert R. Williams at Ft. Rucker, Ala., suffers no illusions that the Eglin tests will be conclusive. It anticipates that, once the records are studied and resolved, they will indicate little more than the direction that should be followed in future research.

Project officer for the Board is Capt. Robert L. Head.

Technical direction is under Marion J. Fortner, the Board's chief aeronautical engineer.

Single Manager Plan Adopted for Airlift

Washington—Defense Department last week ordered the single manager concept applied to airlift and named USAF's Military Air Transport Service as the principal airlift agency. Air Force Secretary Donald A. Quarles was designated the manager.

The order involves transferring both "heavy transport aircraft of the Troop Carrier Element of (the Air Force's) Tactical Air Command" and "certain four-engine aircraft of Navy's Fleet Logistics Air Wing (Flogair)" to the new MATS.

The Defense Department said "additional transport aircraft" will be transferred to the new MATS after its initially assigned aircraft become operational.

Terms of reference detailing the operation and exactly what aircraft will be assigned have not been completed.

MATS is instructed to give "full consideration" to the airlift service available to Defense Department from U.S. civil air carriers.

The Defense Department said the move is "designed to strengthen mobilization readiness . . . assure greater effectiveness, efficiency and economy" in airlift.

The directive ordering the change is in accordance with Hoover Commission recommendations on elimination of duplicating air transport services.

Beech Sales Record

Wichita—Record high of $40 million in commercial aircraft sales, primarily business and utility planes, has been achieved for 1956 by Beech Aircraft Corp. The new mark, up $6.5 million over 1955, actually is some $8 million more than the 1956 quota set for the company's distributors and dealers by Beech President Olive Ann Beech at their annual sales meeting last winter.

New models of the company's business aircraft line, shown to its sales force at the 1956 annual meeting at Wichita Dec. 5-6 include:

- **E50 Twin-Bonanza, powered by 340-hp. supercharged Lycomings providing a top speed of 240 mph. and cruise speed of 228 mph. at 70% power, was initially revealed by Aviation Week, Nov. 26, p. 29. Standard D50 with 295-hp. high-compression Lycomings will also be available.**
- **New H35 Bonanza has 240-hp. Continental giving a top speed of 206 mph. Range is 1,170 mi. with auxiliary tanks.**
- **E18S Super 18 has a 12% increase in range, will now fly 1,626 mi. nonstop with 45 min. reserve.**

J54 150 Hour Test

Kansas City—Westinghouse J54 turbojet engine has passed an unofficial 150-hour endurance test at the corporation's Aviation Gas Turbine Division plant here. The J54 also has made its initial flight test runs in a pod suspended below a North American B-45 jet bomber converted as a flying test bed for experimental jet engines.

The J54 is a privately financed development by Westinghouse aimed at providing a high efficiency turbojet in the 6,000 lb. thrust class. To date, the corporation has spent $13 million of its own funds on development of the J54 and an additional $12 million in engineering facilities.

Waits Smith, Westinghouse vice president and general manager of the Aviation Gas Turbine Division, said the unofficial 150-hour test was run according to military specifications for a production qualification test but that the primary purpose of the test was to prove engine durability.

"During the past seven years, we have been working on development of various titanium metal alloys and methods of machining them on a mass production basis," Smith said. "The J54 is the first engine designed specifically to take full advantage of these lightweight alloys. This test verified our conviction that through the use of titanium it is is possible to build a very light jet engine without sacrificing efficiency, pilot safety or engine durability."

An individual fund will be employed, under which users will pay into a revolving fund for the services they receive.

The directive combining airlift services under a single manager was precipitated by strong disagreement within MATS and Flogair as to whether the merger should be done, and, if so, how. Plans for the move were first announced by Defense Secretary Charles E. Wilson last February.

Although the directive ends the argument as to whether the single manager system will be used, considerable haggling over details is still expected. How many planes Flogair will retain for administrative work, for instance, is a question that probably will have to be settled at a high level in the Defense Department.

The Tactical Air Command's views on the transfer of its "heavy transport aircraft"—presumably four-engine C-124s—have not been aired, but both Navy and MATS were known to oppose the single manager concept. The Navy did not want to give up control of its planes. MATS officials felt that the single manager and industrial funding concepts would create more problems both administrative and financial, than they would solve.

MATS will continue to operate the Air Photographic and Charting Service, Air Rescue Service, Air Weather Service and Airways, Air Communications Services and Flight Service.

News Digest

Douglas Aircraft Co. predicts a 50% increase in engineers—from 2,000 to 3,000—at its El Segundo Division during the next four years.

FJ-4B Fury jet has made its first flight. The Fury will be produced at North American Aviation's Columbus (Ohio) Division for service with carrier-based attack squadrons.

Chesapeake and Ohio Railway has bought a $3.3 million interest in Slick Airways, climaxing six months of negotiations (AW Dec. 10, p. 39). A total of $5 million in debentures will be issued by Slick next month and will be convertible into Slick common stock after Jan. 1, 1959.

Chance-Vought Aircraft, Dallas, Tex., has received its first Navy production contract for the Regulus 2 supersonic surface-to-surface missile. The Regulus 2 is powered by Pratt & Whitney J57.

Personnel of Northrop Aircraft will get a wage increase as a result of company's re-establishment of its cost-of-

ICBM Training Unit

Washington—USAF's Western Development Division of the Air Research and Development Command will move into its program to achieve operational capability with long-range ballistic missiles early next year.

Last week, a major portion of Camp Cooke Military Reservation in California was shifted from Army to Air Force jurisdiction. Next month, a program of modernization will be started to turn the base into a training site for missile units. The base, located near Lompoc, Calif., has been inactive.

The Western Development Division is commanded by Maj. Gen. B. A. Schriever. Its mission is to develop both the IRBM and ICBM weapon systems and carry the projects through to the stage where operational units are ready for assignment to the appropriate USAF command.

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SPECIFICATIONS FOR TYPE D-855

Type: DC motor with integral gear reduction

Terminal voltage: 24

Horsepower: 4.8 at 200 amps

Output RPM: 2600 minimum

Duty Cycle: 10 min. on, 30 min. off

Ambient temperature range: −65°F. to 250°F.

Minimum starting torque: 300% of running torque

Mounting pad: AND 20001

Cooling: Fan cooled with open thru ventilation

Weight: 17¾ pounds

EEMCO TYPE D-855, a DC motor with integral gear reduction, was designed for use in missiles of the latest concept. Like all **EEMCO** motors, as well as **EEMCO's** rotary and linear actuators, it packs maximum performance into minimum dimensions and weight. With a terminal voltage of 24, Type D-855 produces 4.8 HP at 200 amperes with a minimum RPM output of 2600. Duty cycle is 10 minutes on and 30 minutes off, with minimum starting torque at 300% of running torque. Ambient temperature range is −65° to 250° Fahrenheit. Type D-855 is fan cooled with open thru ventilation.

✳ **EEMCO** has had many years experience in the exclusive design and manufacture of airborne motors and actuators. As a result, **EEMCO** is thoroughly skilled and equipped to produce these vital components that must operate unfailingly under the extreme environmental conditions encountered in today's supersonic aircraft and missiles. Thus **EEMCO's** extensive specialization in this field is playing an important part in the reliability of the most modern air weapons now being produced for the nation's defense.

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DOLLAR ENGINEERING—Advanced aerial weapons bearing the Northrop name are developed to achieve maximum economy through ease of production, maintenance, and operation. A notable example is the new supersonic trainer now being developed by Northrop for the U. S. Air Force. Light in weight and low in cost, this airplane embodies a basic concept which can result in a whole new family of effective aerial weapons, all linked by the same principle of simple and economical design. Since national defense dollars and national manpower are in short supply Northrop will continue to introduce the dollar into the engineering equations; will continue to employ "dollar engineering" in using the best science and technology to create the *low-cost* solution to a national defense problem and produce more Air Force per dollar of national defense budget.

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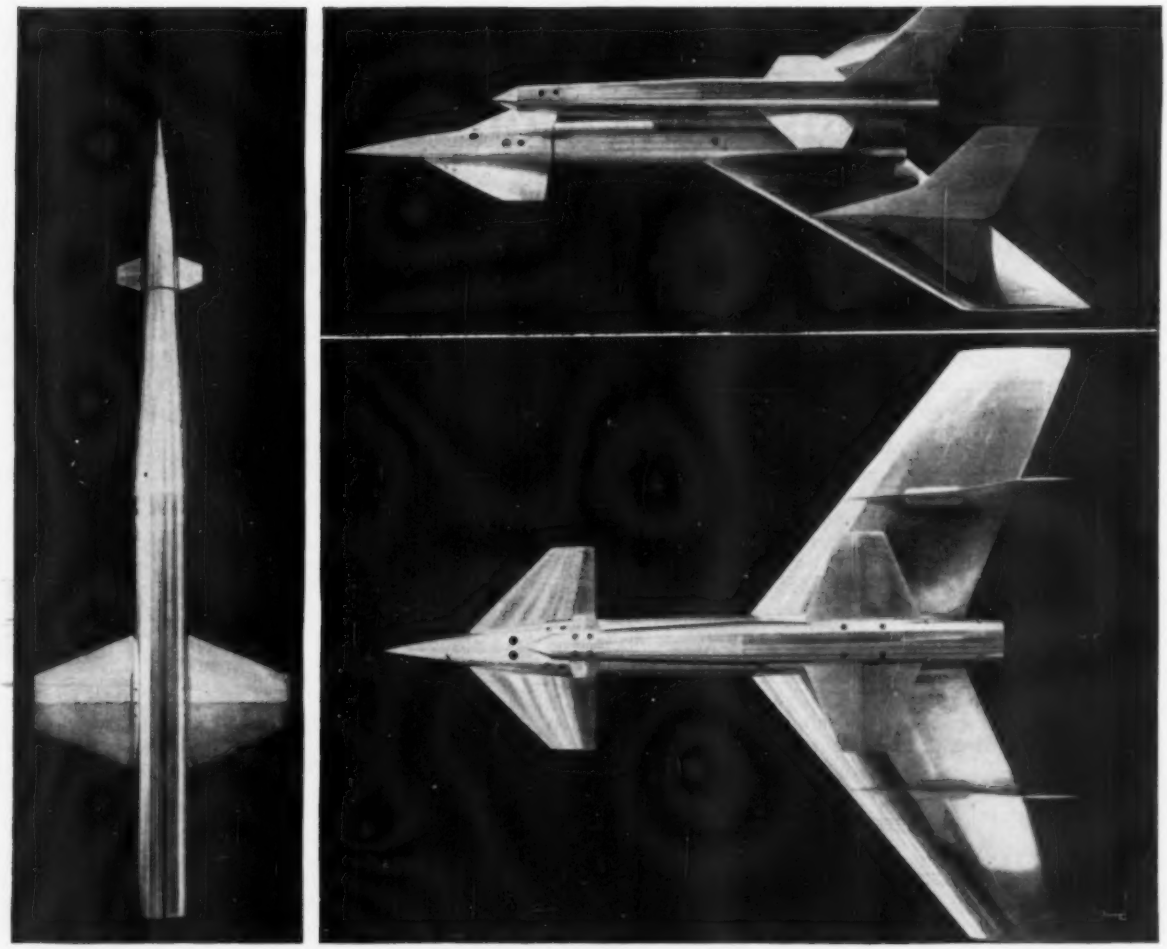


Navaho Configurations

Two wind tunnel models for configuration studies in North American Aviation's Navaho SM-64 program were shown by the company at the recent New York Power Show. Model at left is apparently a study of canard aerodynamics and approximates an early proposed layout of the Navaho missile. At right is a combined model of a proposed ramjet-powered missile atop a canard carrier aircraft. This is believed to be a marriage of convenience for the display and not representative of any Navaho combination. The lower aircraft could have been one of the steps in the study of layouts for the X-10 manned test vehicle, or it might have been a further development of the Navaho canard proposals. Navaho test vehicles now flying at Air Force Missile Test Center are delta-winged, with the wing mounted aft with a large dihedral to make the wing double as a vertical tail. Ramjets are at the wing root and the booster rocket is a jettisonable package under the fuselage. North American X-10 tests are substantially complete.

living program for hourly rated workers. Should the present Consumer' Price Index of 117.7 points prevail on Dec. 15, workers will get a five cent an hour increase that will become effective Jan. 28, 1957.

Contract of $396,800 has been awarded by Chance Vought Aircraft to the T. C. Bateson Construction Co., Dallas, for construction of a building to house the company's new Mach 5 wind tunnel.

Bristol Orion engine has completed 1,000 hours of development testing in past year. Orions installed in a Bristol Britannia accounted for over 50 hours of this total.

Titanium Fabricators Inc., Burbank, Calif., has received a $274,000 contract from Convair Division of General Dynamics Corp. for various missile components.

New Terrier missile was designed, tested, and put into production by Convair even before first version was phased out of production at the Pomona, Calif., facility.

Third prototype of the Bristol Type 173 helicopter has made its first flight. It is the first of the series to be powered by 850 hp. Alvis Leonides Major engines.

North American Aviation Inc. voted a regular quarterly dividend of 40 cents per share payable Jan. 7, 1957 to stockholders of record Dec. 17, 1956. Company also announced that its 17,000 salaried employes would receive a 3.2% cost-of-living pay boost in their base salaries beginning Dec. 17.

French aircraft builder Morane-Saulnier announced it has signed a contract with the Argentine government for the delivery of 48 of its twin-jet Paris liaison aircraft. Actual assembly of the planes will take place in the Argentine state-owned aircraft plant at Cordoba. Contract also provides that up to June 30 of next year the Argentine government can boost the order from 48 to 100.

Smooth Pilot Transition to Jets Expected

By Irving Stone

Los Angeles—Transition training for jet transports will not present any more problems than transition from one piston-powered transport to another.

A. M. (Tex) Johnston, Boeing Airplane Company's chief of flight test, made this prediction before a Los Angeles symposium attended by about 200 industry engineers, pilots and administrators. The meeting was sponsored by the University of California's Institute of Transportation and Traffic Engineering in cooperation with the Aeronautical-Engineering Assn. and the Institute of the Aeronautical Sciences.

Johnston based his findings on checkout in the Boeing 707 jet of approximately 130 pilots representing 25 major airlines all over the world. About 96% of these pilots had not ridden previously in jet aircraft.

Instrumentation required to monitor jet engine performance is very simple, Johnston pointed out. Instruments associated with propellers, carburetors, ignition, cylinder head temperature and engine oil temperature are eliminated.

Power response on missed approaches is identical to what the pilot is now accustomed with piston engines. The Pratt & Whitney J57, he said, idles at 60% rpm., delivering only about 5% thrust, a desirable feature, so that approach will not be too flat. Acceleration from idle to full power is achieved in 4 to 5 sec., same as that for a piston engine.

In a test with the 707 at a landing weight of 170,000 lb., regular letdown was achieved at only one knot in excess of that for the DC-6, Johnston revealed.

In the transition program, Boeing now believes there will be complete ground school instruction. Pilots will become thoroughly familiar with the aircraft systems and their interrelation, plane performance capabilities and limitations. This will be followed by flight training, which should average about 10 hr., Johnston said.

The simulator is a very important tool in pilot transition training and can save valuable aircraft time, he said, but feels that cockpit familiarization may be achieved with an environmental trainer instead of a full-fledged simulator.

Pilot Overloaded

Altitude indoctrination will be mandatory, but Johnston feels this can be accomplished in ground school with use of an altitude chamber. He doubts if it will be necessary to subject the pilot to explosive decompression, and feels that tests on time to act and effects on lack of oxygen will be sufficient.

Johnston revealed that Boeing is making a motion picture with the camera mounted in the 707 in the pilot's location. As a training aid, this will show the transition pilot what he is going to experience in takeoff, approaches and various other flight regimes.

Number of instruments and controls have increased more rapidly than the speed of aircraft, and the pilot is overloaded, according to Jesse Orlansky, vice president, Dunlap and Associates, human engineering and operations research firm. Real problem is that the pilot gets detailed bits of information and must relate this data and come to a decision.

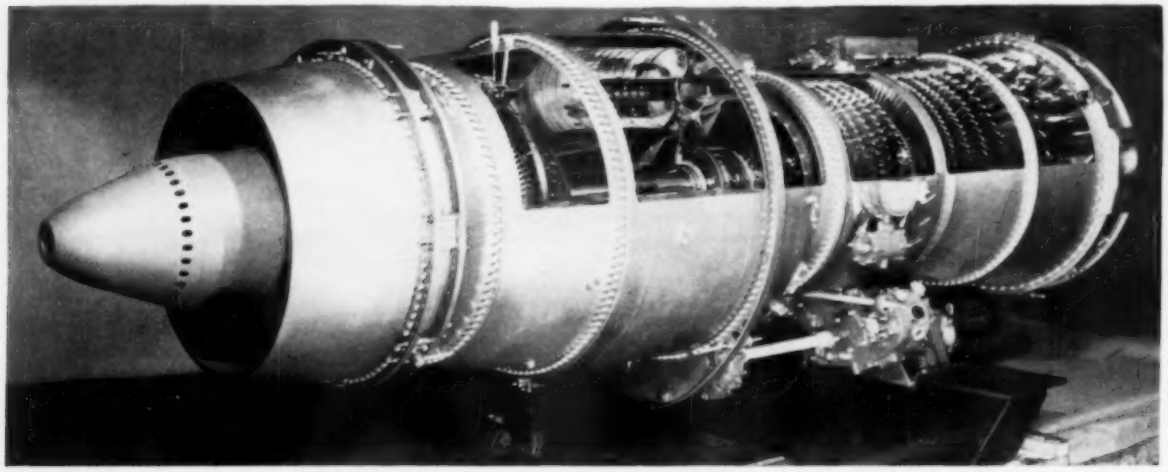
Pilot Evaluation

Orlansky indicated that instrument arrangement should not necessarily be left to the vote of a committee, but rather that pilots should evaluate it in a simulator and in the air. Standards of instrument arrangement arrived at by a committee only indicate an agreement and do not mean that they are the best way of getting a job done, he pointed out.

There is a real need for detailed study of pilot reaction to instrument systems before these actually go into operation. If this had been done to current systems, it would have been discovered that they are inadequate in certain respects, he claimed.

An example of this, he said, is the moving horizon attitude indicator. He contended that the airplane image should move rather than the horizon.

Financing of jet transports has been a big problem, said M. G. Beard, assistant vice president, equipment research,



REAR QUARTER view of Pratt & Whitney J57 which will power Boeing 707 discussed at Los Angeles symposium shows power stages. The first low-pressure compressor stages bring the flow down to the compact parallel-cased high-pressure compressor, after which it is diffused out to the combustor cans, one of which is shown. Fuel introduced in the inner core of the combustion can burns and expands the flow which is then directed in again towards the turbine nozzle vanes, forming jets which impinge upon the first turbine stage. The three turbine stages are hidden by their casings and the thrust producing tailpipe is missing. This cutaway J57 currently is on display at the Massachusetts Institute of Technology.

American Airlines. Introduction of jets may be limited more by financial considerations than the manufacturer's ability to produce them, he pointed out.

Air traffic control will be transport's most knotty problem, although it appears that this difficulty is now on its way to solution by the time jets will be in the picture in large numbers, Beard said. He added that never before has so much research and planning ever been given to a new transport era.

Altitude Data

The fast flight of jet transports will spotlight the relatively slow trips to and from terminal areas, he contended.

Much data have been accumulated on altitude operation (above 25,000 ft.) and it is not expected that structural failure or explosive decompression will occur.

Safety aspects of kerosene as a fuel are desirable, but because of its hygroscopic characteristic, systems will have to be designed to avoid blockage by ice.

Commenting on the advent of supersonic transports, Beard said it would be a long time before the speed threshold of the lower transonic range is exceeded.

Real problem will come in the adequacy of facilities to permit jet operations as an extensive everyday thing, Richard P. Cosgrave, Air Line Pilots Assn. chairman of Council 57, Los Angeles, told the meeting. It is in the area of facilities that broadest and most sweeping changes will have to be made. "It is probably not going overboard to use the word 'revolutionary' in portraying the concepts that will need to be adopted, all-out, or, even large-scale, jet operations," he said. Air line pilots, according to Cosgrave, feel they are going to require:

- **Air traffic control system** capable of handling today's demands many, many times over.
- **More adequate airports** and airport facilities.
- **Better navigational** equipment.
- **Improved weather** forecasting.
- **Communications equipment** to provide improvements jet operations will demand.

Subsonic Flight

Jet transport operational requirements cannot neglect human factors, which in many instances should be predominating in flight deck and instrument arrangement, crew complement, and flight time limits, he claimed.

While reports indicate that jets are no harder to fly than conventional aircraft, this can be deceptive if accepted as a complete statement solely without other considerations, because in jets events will occur much faster, and greater premium will be placed on reaction time and mental alertness, Cosgrave said.

Extensive studies are being made as to the advisability of at least one pilot using oxygen at all times, he declared.

A plateau has been reached for air transports at the high subsonic Mach numbers. Before the big jump can be made to supersonic speeds, the problems of drag and temperature will have to be licked, according to Dr. A. L. Klein, design consultant to vice president of engineering, Douglas Aircraft Co. Keeping the passengers cool at supersonic speeds will be expensive.

Boundary layer noise becomes a very important factor in noise control even at high subsonic speeds, he pointed out, and this noise will have to be brought down to a sensible level. One alleviating factor is that the shorter time of flight will lessen the degree of comfort that normally would have to be achieved.

Passenger Increases

A 1960 forecast of 66 million passengers and a 1965 forecast of 93 million passengers are realistic ones for the domestic airlines, declared Lucius W. Burton, Jr., air advisor to Undersecretary of Commerce and special assistant to Administrator of Civil Aeronautics. If helicopters or other similar vertical lift aircraft effectively develop the true shorthaul market, these forecasts may be too low, he pointed out.

Accuracy of navigational aids becomes increasingly important as more aircraft begin to use the air, flying closer together due to space-saving features of radar control, Joseph H. Tippets, director office of CAA's air navigation facilities, told the meeting. New problems have made it necessary to buy five new aircraft which can be used to check NavAid performance at altitudes up to 20,000 ft., Tippets declared. CAA also has added two B-47s to check system performance at 40,000 ft.

Radio frequencies, he said, must be conserved or there will be an insufficient supply. Careful planning of frequencies requires close coordination with users to avoid derogation due to interference which could render a NavAid or a voice communication channel unusable and unsafe.

Stressing the importance of radar as the biggest single factor in solving air traffic control problems in the foreseeable future, Tippets said it is estimated that radar along with other in-progress improvements in the airways system will increase the capacity of the airways by four times. This depends on the condition that airport capacity keeps pace with the capacity of the air traffic control system.

Export Bank Grants First Foreign Jet Loan

Washington—Export-Import Bank made its first loan for a foreign purchase of U. S. jet transports last week with $16.5 million credit to Japan Air Lines for its DC-8 order.

The bank also issued a $7.7 million credit to help the Japanese carrier pay for the four DC-7Cs it has on order. Japan Air Lines' DC-7C and DC-8 purchases total $42.5 million with spares.

Under terms of the loans, JAL must make an initial down payment of 25% of the purchase price, and Douglas Aircraft Co. has to carry 25% of the financing. The loans cover the balance of the financing.

The money for the four DC-8s is to be repaid in semi-annual installments over a seven year period beginning in 1960. The DC-7C loan is for five years, repayable in semi-annual installments starting in 1958.

In a similar move, the Export-Import Bank granted $6.5 million to Panair do Brasil last month to help the airline pay for the four DC-7Cs it will receive next spring. The five-year Panair loan was guaranteed by five Latin American banks.

Hangar, Shop Loans Authorized

Washington—James Pyle, acting Civil Aeronautics Administrator, has completed an agreement with the Small Business Administration authorizing loans to flight schools and air service operators for the construction of hangars, shops and classrooms.

In the agreement, the Small Business Administration has urged the participation of local banks in handling the loans, although this is not a requisite. Interest rates on loans in which local banks participate will be no less than 5%, no more than 6%.

With no bank participation, the SBA will lend up to $250,000 at 6% interest. Repayment can be arranged on an installment basis over a period of 10 years.

Pyle said the Federal Aid Airport Act does not provide funds for such facilities.

The operators previously have been hampered in borrowing funds because buildings are often located on leased land. However, such building property will now qualify for loans if the lease meets SBA requirements.

CAA field offices will be equipped to assist applicants in obtaining loans under the plan, Pyle said. According to Aircraft Owners and Pilots Assn. an estimated $90 million is needed immediately.

CAB Awards Routes To Local Lines

Washington—Civil Aeronautics Board has awarded routes to Lake Central Airlines and Allegheny Airlines that give both local airlines new access to major terminals.

Modifying an earlier decision in the Erie-Detroit Case, the Board last week extended Lake Central's system from Erie, Pa., to Buffalo, N. Y. In the original decision, Lake Central was extended from Youngstown to Erie.

When it reconsidered its decision on Lake Central's route, the Board also decided to liberalize the skip-stop restrictions imposed on Allegheny for Detroit-Philadelphia-New York flights. Both changes were announced in a press release, and the opinion and orders will be issued in a few weeks.

The CAB also announced in a press release on the Lima-Detroit Case that it had decided to extend Lake Central's system from Lima, Ohio, to Detroit via Toledo. The Board turned down North Central Airlines' application for the same route.

Lake Central's new route was awarded for a period of three years or until 60 days after a decision is reached in the Great Lakes Local Service Investigation, whichever comes first.

In a third decision, the Board gave Allegheny an exemption that permits the airline to compete with Capital Airlines between Washington and Harrisburg, Pa. Allegheny serves both cities, but it has not had the authority to fly directly between them.

Allegheny has applied for a permanent Washington-Harrisburg route, and the CAB issued the exemption for temporary service until a decision is made on the airline's application for permanent authority.

EAL Hikes Capacity Of N. Y.-Florida Run

Washington—Eastern Air Lines has leased a dozen Constellations from Trans World Airlines and Seaboard and Western Airlines to provide extra coach capacity during the winter season.

With the rented coach equipment, Eastern will be able to offer two million seats between Florida and northern points this winter. Schedules call for 200 flights a day in and out of Miami during the season.

The rentals from TWA and Seaboard and Western, plus recent deliveries of new DC-7B and Super-G Constellations, will give Eastern added capacity to meet the demands of burgeoning Florida traffic and the new competition supplied by the Civil Aeronautics Board on the East Coast route.

Northeast Airlines, new competitor of Eastern and National Airlines on the New York-Florida route, discussed leasing Constellations from both TWA and Seaboard and Western. The new Florida carrier was interested in securing interim equipment for its new route until DC-6Bs now on order are delivered.

Northeast was not able to find a deal to its liking and will wait for its DC-6Bs to start a New York-Florida service. The airline will not be a serious competitive factor in the Florida market until next year when it has ten DC-6Bs and five Bristol Britannias in service.

Eastern's contract with TWA calls for the leasing of six Constellations until May 15. The six aircraft leased from Seaboard and Western are Super-G Constellations, and the lease runs until June 15.

The Seaboard contract required Civil Aeronautics Board approval because the six transports represent a major part of the freight airline's property. The Board approved it because of the short term of the lease and Eastern's pressing winter traffic demands.

Seaboard and Western now has four C-54s in addition to its six Super Constellations and will take delivery on four more Super Constellations within the next three months. The cargo carrier told the Board that income from the lease would strengthen its economic position and that it did not think it could utilize all its aircraft with maximum efficiency this winter, especially those in passenger configuration.

Airports Receive New Taxi Light

New York—New type of taxiway light which presents a columnar shape instead of a pinpoint to the pilot's eye will be installed by Port of New York Authority on new taxiways now under construction at New York International and Newark Airports. PYNA has ordered 1,129 units of the 28-in.-high, blue plastic lights from Steiner Universal Co. at a price of $40,531.

The lights, containing slimline fluorescent lamps, have been under test at Idlewild for about a year and have been evaluated by airline pilots using the field. Reaction generally was favorable. Civil Aeronautics Administration will evaluate the forthcoming installations after a year's operation and will then consider writing specifications on them.

Developed by LaGuardia Airport Manager Edward Ingraham with the aid of Port Authority engineers, the lights are said to use less power than their incandescent counterparts and to last longer. Savings amount to about $14 per unit per year, according to PYNA.

The lights are slightly higher than conventional taxiway lights, and their possible effect on propeller blades was tested by Hamilton Standard. "No apparent physical damage" to prop blades resulted, the company reported. Like other lights, globes are frangible.

The pilot survey was conducted through Air Transport Association and found most pilots pleased with the "linear effect" provided by the cylinders of light.

Improvements in the columnar lights as ordered by PYNA over earlier test versions include the straight instead of hairpin fluorescent lamp, and a master transformer instead of small regulators in each unit.

Atlantic Charter Business Booming

By Glenn Garrison

New York—Chartered planes of the scheduled and contract carriers lifted about 70,000 commercial and military passengers across the North Atlantic last summer, almost a fifth as many as the transatlantic airlines carried on scheduled flights in the same June-through-September period.

Prospects are excellent for continued good charter business on the route, the carriers believe. In addition to normal markets, a spurt of extraordinary activity is resulting from the accelerated movement of Hungarian refugees into McGuire Air Force Base.

Practically every available DC-4 owned by a contract carrier in this country will be over the Atlantic this month with a planeload of the refugees, either under Air Force or Intergovernmental Committee for European Migration auspices. As of last week, it appeared that the total of Hungarians airlifted from Austria to the United States by chartered aircraft will approximate 15,500.

Military to Help

Roster of the participating carriers numbers above 10, some of them far from their normal scene of operations. In addition, Military Air Transport Command aircraft—Air Force C-118s (DC-6s) and C-121s (Constellations), and Navy R6Ds (DC-6s)—will lift another 6,300 of the Hungarians to McGuire.

The MATS part of the airlift will involve 104 flights by the military, 46 flights by commercial carriers. About 3,200 of the refugees will move in MATS-chartered planes. Both types of movements began last week and all are scheduled for completion by Dec. 31. All MATS flights depart from Munich, both military and civil.

ICEM had lifted about 3,000 Hungarians from Vienna and Linz to McGuire by last week, will bring in 3,000 more by the end of this month under present plans.

The refugee agency has provided a continuing source of charter business to the airlines—both contract and scheduled—for about five years, during which the agency reports about 50,000 persons have been flown to the United States. The Hungarian airlift will involve about 100 planes chartered through ICEM. Contract carriers have bid in all the ICEM Hungarian business to date, with no charters going to the scheduled passenger airlines.

Transatlantic carriers are flying Hungarians into Canada, too, on ICEM-chartered planes. The agency says 2,150 of the refugees have been brought to Canada so far, most of them by air, and that country has not set a limit on admittances. Foreign-flag airlines serving New York have brought some of the refugees for transshipment to Canada.

Even without the Hungarian airlift, the carriers are predicting increases of up to 20% in their overall 1956 transatlantic charter business. Last summer's breakdown by carrier:

• **Flying Tiger Line,** with a four month total of 27,220 passengers, topped its prediction earlier this year (AW June 25, p. 38) by several thousand and says its advance bookings indicate a doubled business next summer. Military charters accounted for 7,900 passengers in the 1956 Tiger summer total, and the airline has been handling a major share of ICEM movements. (Among later ICEM trips by Flying Tiger was the first planeload of Hungarian refugees, which arrived at McGuire last month with considerable publicity.) The airline has scheduled 28 ICEM flights for December, as of last Tuesday had been awarded five of the Air Force Hungarian charters.

• **Slick Airways** carried some 6,800 passengers during the four months, split about fifty-fifty between commercial and military. Ten of the Air Force Hungarian charters have been awarded to Slick for operation this month. Slick also has been handling ICEM flights.

• **Seaboard and Western's** transatlantic total was down from 28,000 last summer—all military—to about 11,000, also all military contract work. Reason for the drop: many Seaboard aircraft were busy with Pacific charters during the period.

• **Trans Caribbean Airways,** another regular Atlantic charter operator, carried 4,200 passengers during the four months, 71% of them on military contract flights. Trans Caribbean is getting some of the Hungarian flights through Air Force contract.

• **Scheduled International** Air Transport Association airlines handled 17,000 passengers on chartered flights during the summer. Westbound total was 9,500, up 19% from 1955, and eastbound charter traffic was up 9% to 7,500 passengers.

Policy Change

Pan American carried 6,246 of these summer charter passengers, 13% less than the airline handled during the same four months of 1955. The drop, according to Pan American, resulted from a policy change in which the practice of booking flights one way as charters and the other way as scheduled flights has been discontinued. In the past, the airline says, a plane might fly to Europe as a one-way charter, return as a scheduled flight, or vice versa. Now all regular flights are scheduled in both directions, and hence there was less charter equipment available last summer.

Pan American, however, expects an overall increase for the year, with a spurt of business this month through bringing military personnel home from Europe for Christmas.

Trans World Airlines handled 2,787 charter passengers last summer, of which 1,798 were military dependents.

KLM Royal Dutch Airlines, second to Pan American as an IATA transatlantic charter operator, led the scheduled field during the summer with 8,500 charter passengers.

Most of KLM's business was commercial, and the airline reports a trend in charter bookings toward earlier and later months: more people left the United States in May and returned in July, or left in August and came back in October than during the previous year. This widening of the heavy charter months helps with the problem of filling off-season seats.

Airline officials don't expect the new IATA excursion fares to affect the civilian charter market appreciably, because the price differential still is considerable. But some foresee a major shift from chartered to scheduled sales

PAA, Flying Tiger Sign Charter Pact

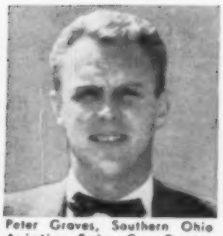
Washington—Pan American World Airways and the Flying Tiger Line last week asked the Civil Aeronautics Board for approval of a plan under which the two airlines would work together to promote international charter business.

Pan American and Flying Tigers would work jointly to develop group travel overseas under the agreement. Most of the business would be on U. S.-Europe routes, but the service would be available to other points around the world.

Under the airlines' proposal, Pan American would operate the charter service and provide passenger and ground facilities, and each carrier would assign aircraft to the service. Flying Tiger Line would become the general sales agent for Pan American in the U. S. for planeload charters. Initially, Flying Tiger plans to place two 1049H Constellations in the operation.

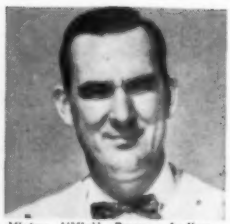
Don Vest, Vest Aircraft & Finance Co., P. O. Box 5306, Sky Ranch Airport, Denver, Colorado.

Gene Hudmon, Stonnell and Holladay Aircraft Sales, Carolina Division, Municipal Airport, Charlotte, North Carolina.

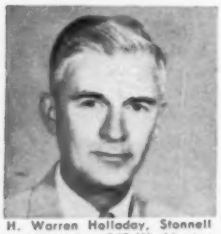


Peter Graves, Southern Ohio Aviation Sales Co., Dayton Municipal Airport, Vandalia, Ohio.

John Wilsdon, Hunter Aviation Co., P. O. Box 122, Lambert Field, St. Louis, Missouri.



Victor "Vic" Bruce, Indianapolis Executive Aircraft Corp., Indianapolis Municipal Airport, Indianapolis, Indiana.

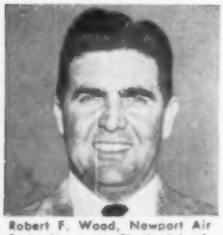


H. Warren Holladay, Stonnell and Holladay, 843 Washington Building, Arlington Towers, Arlington, Virginia

Norman Hoffman, West Texas Flying Service, Midland Airport, Box 82, Midland, Texas.

H. Leibee Wheeler, Buffalo Aeronautical Corporation, Buffalo Municipal Airport, Buffalo, New York.

John S. Brown, Brown Aero Corp., 3100 Love Field Drive, Dallas, Texas.



Robert F. Wood, Newport Air Park, Newport, Rhode Island.

Wynn Cronje Minnesota Airmotive Inc., Minneapolis St Paul International Airport Minneapolis Minnesota

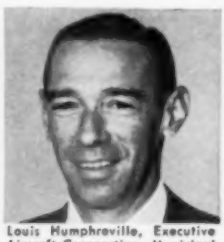
A. M. "Sime" Bertolet, Reading Aviation Service, Inc., Municipal Airport, Reading, Pennsylvania.

Max R. Brand, Aero Commander Dist. (Downtown Airpark), Hangar 3, Municipal Airport, Tulsa, Oklahoma.

E. H. "Ted" Tolan, National Aero Sales Corp., Midway Airport, Chicago, Illinois.

W. D. Maddox, Aero Southern Corp., 601 North Broadway, Nashville, Tennessee.

W. H. "Bill" Buchanan, Sales Manager, Johnson Air Interests, Inc., Harlick-Racine Airport, Racine, Wisconsin.



Louis Humphreville, Executive Aircraft Corporation, Municipal Airport, Pontiac, Michigan

Jack Hale, Chamberlain Aviation, Inc., Akron Municipal Airport, Akron, Ohio.

John A. "Jack" Bauman, Santa Monica Aviation, 3011 Airport Avenue, Municipal Airport, Santa Monica, California.

Harrel Bellamy, L. B. Smith Aircraft Corp., Miami International Airport, Miami, Florida.

Lucien M. Taillac, Trans-Aire Corporation, Pan-Air Building, New Orleans Airport, New Orleans, Louisiana

Jack Gregg, Northern Aircraft Co., International Terminal Building, International Airport, Oakland, California.

Robert M. Brown, Commander Sales Company, Terminal Building, International Airport, San Antonio, Texas.

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when and if the third-class transatlantic fares go into effect in 1958.

Some advantages would remain with the charter arrangement even if fares were the same, in the opinion of a KLM official. Many people would take an air trip as group members who would not as individuals, according to the official. Besides this psychological consideration, charter groups can make special arrangements for food service and the like for their trips.

The cut-rate off-season immigrant fare approved in October by Civil Aeronautics Board (AW Oct. 22, p. 43) will not seriously affect the ICEM charter business. Flying Tiger says charter fares for the immigrants are still $25-30 lower per person than scheduled fares.

Lebanon, Turkey and Iraq Reach Agreement on Routes for Airlines

Beirut—Lebanon, Turkey and Iraq have reached agreement on the route to be taken by international airlines on their Europe-Far East lines.

All the airlines that formerly used Beirut International Airport (AW Dec. 10, p. 38) and then switched to Istanbul and Ankara during the Suez crisis will now revert to Beirut. They will take Route 5 which goes north to Adana in Turkey, then east to Diarbekr and the Iraqi border, then south to Baghdad and the Persian Gulf and then to the Far East.

Lebanese civil aviation officials hope not only airlines which used Beirut before the Suez war will now return to Beirut, but those that can no longer make use of the facilities of Cairo Airport. These officials hope that with the new measures, traffic at Beirut airport will be 60% of the pre-Suez rate in the next week, and will return to normal in the weeks after.

Lebanese officials said the calm political atmosphere in Lebanon, as compared to that of Syria, as well as airport and hotel facilities in Beirut were factors which convinced commercial airlines to continue to use Beirut as their mid-eastern stop-over.

Beirut Idle

All through November, Beirut International Airport was nearly completely idle and this seriously affected Lebanon's economy. Because of the Syrian ban on overflying until Nov. 26, and then the many restrictions, even the regional flights to Amman, Jerusalem, Cairo, etc., were canceled. Hotel business was hard hit in Beirut, and despite the presence of American evacuees and Syrians and Lebanese from Syria and Egypt seeking the safety of Beirut most first-class hotels were only 20% full.

After the overflying ban was partially lifted in Syria and Egypt, only one regional airline was authorized to resume flights between Beirut, Amman and Cairo. It was Air Jordan, with American crews, and joint American-Jordanian capital, in which Soliman Nabulsi holds majority interest. Nabulsi is Prime Minister of Jordan and president of the National Socialist Party.

The bitter tug-of-war between Syria and Lebanon over airlines making use of the facilities of Beirut and Damascus airports came about when Syria imposed a series of restrictions on airlines using her air space.

Damascus Instead

The gist of the Syrian restrictions was in effect an invitation to international airlines to abandon the modern Beirut International Airport in their east-west traffic and use Damascus Airport instead.

If they didn't use Damascus Airport, they couldn't fly over Syria and had to make the expensive time-consuming detour via Ankara and Baghdad, thus by-passing Beirut as well.

Not only did the Syrians clamp the restrictions, they approached international airlines individually to have them use Damascus Airport instead of Beirut.

At least one airline, KLM Royal Dutch Airlines, announced here it had decided to by-pass Beirut for all its through-traffic. KLM had 26 weekly flights over Syria and Lebanon before the Suez war. Five of these used Beirut as terminal (and they will still use it as such). Two landed at Damascus en route to the Far East. And 19 flights used the Syrian air space after landing at Beirut. These 19 flights would now fly over Lebanon, but land at Damascus instead.

The Lebanese were quick to grasp the danger of the Syrian move, especially if more of the 22 international lines that used Beirut before the Suez war followed KLM to Damascus.

The Lebanese civil aviation department passed a decision banning all flights through Lebanon's air space or Lebanese territorial waters as of December 3, except for planes landing at Beirut International Airport. Lebanese sources denied this was a retaliation to the Syrian move. They said it was due to the present situation in the Middle East. But there was no doubt that, coming so soon after Syria's attempt to force commercial airlines to land at Damascus instead of Beirut, this was Lebanon's answer to Syria.

Eastbound flights from Europe could avoid Lebanese air space entirely by entering Syria directly from the Mediterranean over Syria's coastline. But this is outside the corridor authorized by the Syrians and the Syrian army is unlikely to let any planes fly over an area (Lattakia harbor) where Soviet ships are daily unloading arms and massing them inland.

At any rate, Lebanon's stiff move seemed to have worked. KLM canceled its previous decision to bypass Beirut and land at Damascus instead.

Hungary's MALEV Airline Crippled

Vienna—Hungary's government owned and operated MALEV airline was forced to stop operations by the revolt. Three of its five Ilyushin-14s have been impounded by Austria and two were destroyed in the fighting.

When the revolt broke out, MALEV officials turned against the government and delegated three Il-14s to fly relief supplies from Vienna. The three planes were grounded Nov. 2, when Soviet tank units succeeded in surrounding all Hungarian airports.

When the Russians intervened in force Nov. 4, the remaining two planes were burned in the fighting for Ferihagy Airport. Austria has demanded precise description and proof of ownership before releasing the three planes in Vienna.

SHORTLINES

▶ **Air Line Agents Assn.** has signed an 18 month contract with United Air Lines covering flight simulator operators. The agreement provides for a pay increase of $30 per month and for payment by United of 25% of the group's yearly accident and sickness insurance premiums.

▶ **Cities Service Oil Co.** has been awarded the gasoline concession at Cleveland's Hopkins Municipal Airport on its offer of turning over 17% of gross sales to the city. Other bidders were Standard Oil of Ohio with 9.65% and Shell Oil Co. with 5.15%.

▶ **Over 50 Fokker F-27** Friendships powered by Rolls-Royce Dart engines have been ordered by European and American airlines.

▶ **Aviacion y Comercio,** the Spanish airline, has ordered eight de Havilland Heron transports with a 14 seat configuration for use on domestic routes stem-

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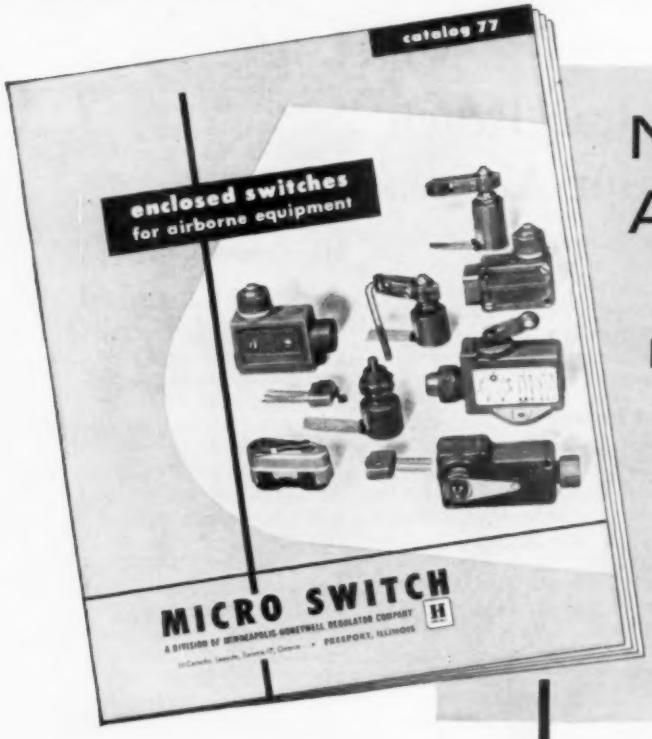

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ming from Madrid, and on overseas routes to North Africa, Mediterranean islands and the French Riviera.

► **British Overseas Airways Corp.** will introduce sleeper seats on its first-class Argonaut service to West Africa in January. Stratocruiser service will be inaugurated on BOAC's London-Lagos and London-Accra routes in April.

► **Continental Air Lines** has broken ground for its new $2.5 million overhaul and maintenance base at Los Angeles. First stage of construction is scheduled for completion by April 1957, in time for the inauguration of service between Los Angeles and Denver, Kansas City and Chicago.

► **International Air Transport Assn.** has issued a second edition of its IATA Facilitation Policy Manual.

► **KLM Royal Dutch Airlines** predicts that 1.25 million tourists will spend about $139,000,000 in the Caribbean area this winter.

► **Linea Aerea Nacional de Chile** has ordered four DC-6Bs for delivery during the last half of 1958. Delivery of the $6 million order will give LAN a fleet of seven DC-6Bs. The LAN purchase brings Douglas orders for DC-6/7 series aircraft to 273.

► **Northeast Airlines** reports an 11.5% increase in passenger traffic for November. The airline carried 43,663 passengers in November as compared with 39,147 passengers in November 1955.

► **Ozark Air Lines'** passenger traffic rose from 22,239 passengers in November 1955, to 27,859 last month for a 20% increase.

► **Riddle Airlines** carried 5,626,290 lb. of cargo in November, a 28% increase over October and an increase of 164% over cargo traffic in November 1955.

► **Resort Airlines'** operating revenues were $595,720 in November, a 45% gain over the same month last year. In the past five months, Resort has reduced its long term debt from $1,737,000 to $1,194,000 and has increased net working capital from $339,753 to over $1 million.

► **San Francisco** International Airport's passenger traffic increased 15% between October 1955, and last October, while aircraft arrivals and departures increased only 0.4%.

► **United Air Lines** has signed an interline agreement with Fiji Airways, a carrier which serves five cities in the Fiji Islands.

AIRLINE OBSERVER

► **Trans World Air Lines pilots are flying into Cairo and Tel Aviv on a volunteer basis only. Each captain is provided $50,000 life insurance by the airline, with co-pilots and relief pilots receiving $30,000. In the event of internment, each pilot will receive 85 hours pay per month at the rate of his monthly guarantee. Service to the two cities was discontinued on Oct. 30. It was resumed into Tel Aviv Dec. 7, Cairo on Dec. 9 (AW Dec. 10, p. 38).**

► Airline profits for 1956 will show no improvement over last year and may even decline despite an expected 12% increase in passenger-miles. The rise in expenses is outstripping revenue increase, continuing a trend that took a sharp turn for the worse during the third quarter of 1956.

► **Delivery of Capital Airlines' original order of 60 Viscounts will be completed within two weeks of the Jan. 1 target date set two years ago by Vickers-Armstrongs when the contract was signed. The 53rd aircraft was scheduled to arrive in Washington last week.**

► Military Air Transport Service has awarded contracts totaling $7,600,000 to six airlines for Atlantic and Pacific airlifts. Standby contracts were awarded to 21 other airlines to handle airlifts on call for MATS.

► **Trans World Air Lines has applied to the Civil Aeronautics Board for authority to suspend its international flights serving Chicago and Detroit from Dec. 27 to May 15. The route was opened in May 1946, but was temporarily suspended during the winter seasons of 1949 through 1954. Last year, the airline retained the flights and experienced a monthly load factor as low as 5% out of Chicago, 10% out of Detroit. Last January, the flights, which operate once a week to Paris, Zurich, Rome, Athens and Cairo, carried no mail from Chicago. Passenger average was 2.7 per trip. From Detroit, mail averaged 5 lb., passengers 5.7 over the same period.**

► Britannia purchase by Northeast Airlines (AW Dec. 10, p. 41), plus latest order for two of the turboprop transports by Hunting-Clan Air Transport, bring total sales of the Bristol aircraft to 62.

► **Pan American World Airways will discontinue its jet stream flights across the Pacific until its Boeing Startocruisers are replaced with DC-7Cs. Extra fuel reserves and multiple crews that are not needed when a stop is made at Wake Island make the Boeing jet stream flights uneconomical. Use of the jet stream cuts flying time from a scheduled 18 hr. to 10 hr. or less on Tokyo-Honolulu flights.**

► Canada's Department of Transport may be split into two ministries early next spring, with one department handling marine transportation, the other telecommunications, aviation and railroads. Lionel Chevrier, former minister of transport and now chairman of the Canadian St. Lawrence Seaway Authority, is expected to head the new telecommunications department.

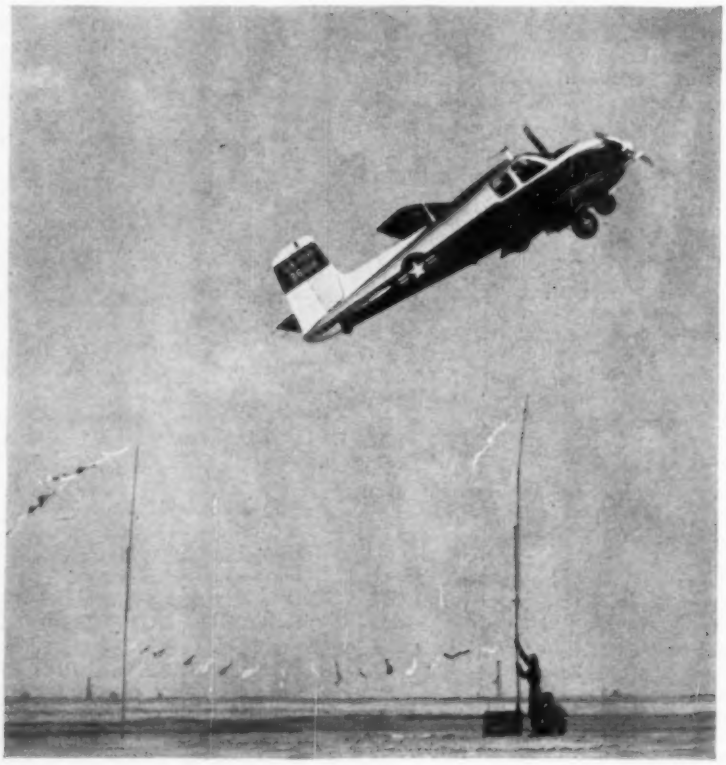
► **International Civil Aviation Organization may assume responsibility for legal problems concerning outer space. The organization's legal commission has agreed to include the subject in its general work program some time in the future.**

► Port of New York Authority will ask for bids in a few weeks for a fifth air cargo building at New York International Airport (Idlewild). Original plans called for three buildings, with the fourth being added as construction began. The fifth building is necessary since demands for space already are outstripping existing facilities.

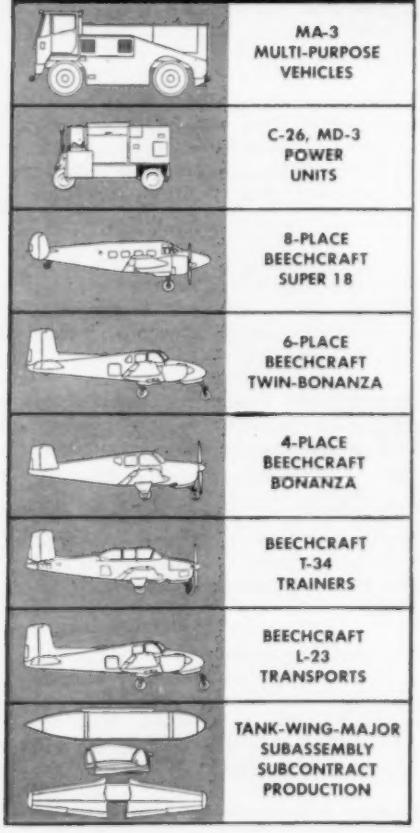
► **Air Transport Assn. has proposed a revised dues formula for members that will provide a more equitable charge to all-cargo carriers who have recently become members of the association. The new formula uses 100% of revenue ton-miles as a basis for fixing pro-rata dues to members. However, only 50% of revenue freight ton-miles performed in domestic service will be applied in calculating over-all charges to be pro-rated.**

CAPABILITIES . . . Manpower, Tools and Experience

The amazing photograph at right was taken by Tom Ashley, managing editor of *Flight Magazine,* at the National Aircraft Show in Oklahoma City over the Labor Day weekend. It shows a U. S. Army L-23 Beechcraft making a successful takeoff and climb over a simulated obstacle, represented by the two poles. A previous takeoff by another make airplane had cut the upper ribbon, which the photo shows as broken. The number at the base of the pole represents the distance in yards from the beginning of the takeoff run of the L-23.



BEECH BUILDS



The U. S. Army L-23B transport, rugged military version of the famous Beechcraft Twin-Bonanza, has a proud and distinguished record of service. First ordered into military production in 1952, the L-23 was the first twin-engine airplane used by the Army Field Forces. From the battle fields of Korea to the training fields at home, and back again to foreign stations, the L-23 has met the exacting demands of military service with distinction. Today, the Army's confidence in the L-23B's dependability and superior performance has resulted in new orders to fill the Army Aviation Division's expanding needs.

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Airline Income and Expenses — 3rd Quarter 1956

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Subsidy	Total Operating Income	Total Operating Expenses	Net Operating Income (before taxes)
DOMESTIC TRUNK								
American	$67,907,960	$1,571,840	$929,589	$3,918,147	$.....	$75,500,779	$63,402,661	$12,098,118
Braniff	10,159,507	281,257	147,221	295,265	.....	11,124,567	10,435,254	689,313
Capital	16,341,395	307,770	211,502	268,592	.....	17,357,738	17,940,207	−582,469
Continental	4,267,721	107,065	32,797	104,865	105,279	4,737,923	4,331,847	406,076
Delta	14,545,526	359,237	247,121	464,778	.....	15,936,851	15,079,016	857,835
Eastern	45,808,615	854,020	487,721	729,397	.....	48,941,288	47,122,779	1,818,509
National	9,252,575	200,569	44,731	268,381	.....	10,361,763	9,624,639	737,124
Northeast	2,927,719	27,237	27,099	59,900	263,451	3,357,025	3,040,616	316,409
Northwest	13,232,908	391,718	232,688	558,583	.....	14,606,065	12,374,253	2,231,812
Trans World	44,013,513	981,019	780,894	1,261,588	.....	47,773,665	45,369,398	2,404,267
United	61,904,136	2,004,412	1,087,257	2,936,644	.....	69,654,281	58,394,614	11,259,667
Western*	.....	.....	.....	.....	.....	.....	.....	.....
INTERNATIONAL								
American	1,353,643	39,850	882	191,874	.....	1,640,618	1,332,760	307,858
Braniff	1,459,200	79,352	.....	90,690	269,867	1,998,597	1,588,356	410,241
Caribbean Atlantic	332,489	4,364	.....	10,929	.....	375,001	333,157	41,844
Delta	1,294,106	14,813	.....	32,438	.....	1,397,601	1,148,449	249,152
Eastern	4,172,305	57,840	.....	51,511	.....	4,543,976	3,429,617	1,114,359
National	747,570	8,378	3,252	21,642	.....	799,778	930,614	−130,836
Northwest	4,663,083	1,355,007	14,571	800,641	.....	7,261,536	5,970,837	1,290,699
Pan American								
Alaska	1,506,518	58,616	.....	271,967	336,872	2,251,525	2,182,768	68,757
Atlantic	33,242,900	2,224,873	.....	2,087,703	516,422	39,248,861	30,897,966	8,350,895
Pacific	14,879,772	1,753,658	.....	1,625,650	262,310	19,541,815	15,993,782	3,548,033
Latin America	17,479,554	667,831	.....	2,545,243	1,556,010	23,785,554	21,496,858	2,288,696
Panagra	3,823,419	251,973	.....	335,596	.....	5,030,136	4,630,110	400,026
Trans World	18,225,251	1,566,138	.....	919,965	.....	21,646,004	17,888,489	3,757,515
United	4,095,198	85,926	.....	42,557	.....	4,273,559	3,018,762	1,254,797
LOCAL SERVICE								
Allegheny	1,300,465	20,134	30,632	17,320	401,776	1,796,940	1,864,357	−67,417
Bonanza	416,444	8,259	5,023	13,336	308,143	776,209	736,273	39,936
Central	305,070	9,247	2,936	9,663	515,981	862,607	838,095	24,512
Frontier	824,390	27,328	8,161	63,152	624,481	1,582,419	1,529,642	52,777
Lake Central	349,852	9,026	17,912	.....	324,343	709,746	705,513	4,233
Mohawk	1,123,777	12,882	12,515	20,255	157,501	1,389,930	1,547,262	−157,332
North Central	1,845,550	51,031	27,552	.....	234,249	2,229,945	2,161,236	68,709
Ozark	850,141	25,937	19,231	22,668	549,614	1,482,632	1,619,809	−137,177
Piedmont	1,337,337	25,991	19,585	17,734	695,339	2,138,430	2,022,256	116,174
Southern	503,741	21,760	16,313	.....	402,612	972,815	1,021,598	−48,783
Southwest	885,687	25,214	10,364	10,807	463,888	1,479,013	1,337,533	141,480
Trans Texas	805,011	27,629	11,592	30,280	573,364	1,467,160	1,582,526	−115,366
West Coast	596,681	10,104	4,288	10,559	418,034	1,053,780	958,317	95,463
HAWAIIAN								
Hawaiian	1,300,590	8,815	.....	183,988	61,554	1,583,271	1,381,145	202,126
Trans Pacific	651,807	1,945	.....	25,635	13,152	712,588	630,374	82,214
CARGO LINES								
Aerovias Sud Americana	.....	.....	.....	429,043	.....	480,404	509,964	−29,560
Flying Tiger	.....	27,340	40,536	2,016,325	.....	2,468,581	2,590,242	−121,661
Slick	.....	51,656	68,688	2,090,859	.....	5,511,338	5,283,545	227,793
Riddle*	.....	.....	.....	.....	.....	.....	.....	.....
Seaboard & Western	.....	.....	.....	682,397	.....	4,865,926	4,818,602	47,324
HELICOPTER								
New York Airways	87,987	6,981	4,503	7,140	325,874	443,178	482,878	−39,700
Los Angeles Airways	36,537	28,700	19,152	.....	175,964	261,685	282,629	−20,944
Chicago Helicopter	.....	19,693	.....	.....	104,972	128,041	133,997	−5,956
ALASKAN								
Alaska Airlines	538,138	132,356	4,573	260,976	284,002	1,743,131	1,558,386	184,745
Alaska Coast	247,937	26,112	.....	24,718	96,015	443,855	346,368	97,487
Cordova	53,994	24,487	.....	28,867	43,453	537,939	458,000	79,939
Ellis Air Lines	180,549	16,917	.....	19,063	63,285	335,598	249,344	86,254
Northern Consolidated	293,044	79,841	1,494	140,194	108,997	898,997	815,297	83,420
Pacific Northern	1,929,040	153,801	.....	289,872	1,165,363	3,620,902	2,322,063	1,298,839
Reeve Aleutian	178,786	56,026	.....	33,743	99	364,616	249,631	114,984
Wien Alaska	354,971	102,994	.....	93,755	125,119	1,862,648	1,782,212	80,436

*Not available.
Compiled by Aviation Week from airline reports to the Civil Aeronautics Board.

READY FOR ACTION

DOUGLAS B-66, ALL-WEATHER TACTICAL BOMBER TAKES OFF FOR PRACTICE MISSION

B-66, Protected by General Electric Automatic, Electronic Tail Armament Gives TAC Greater Mobility, Flexibility

Built for high-speed interdiction and reconnaissance, the Douglas B-66 is the latest addition to the Tactical Air Command's offensive power. General Electric's MD-1, electronic tail armament system provides an accurate, defensive punch to help the all-weather bomber accomplish its mission.

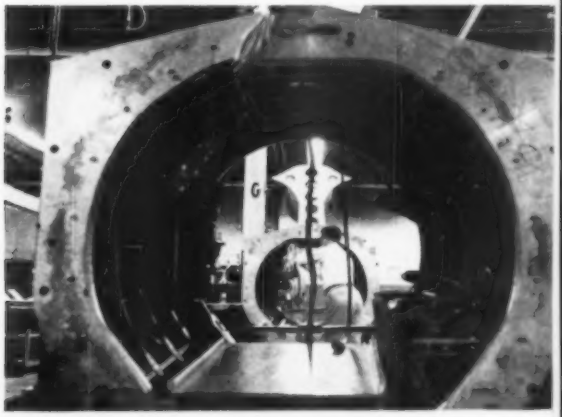
To assure optimum integration of components and continuously high performance of the equipment in the field, the system is completely assembled and tested at the factory and followed through operational usage by highly skilled General Electric technicians. General Electric's complete, follow-through service helps keep the B-66 tail defense system truly "ready for action"—ready to counter with speed, precision, and reliability. 222-5

ENGINEERS: Expanding electronic bomber defense projects at G.E. are creating opportunities for you. Contact C. E. Irwin, Aircraft Products Department, General Electric Company, Johnson City, N.Y.

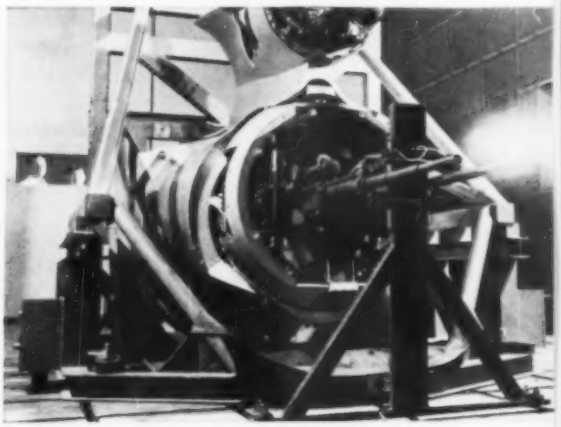
Progress Is Our Most Important Product

GENERAL ELECTRIC

OVER-ALL CAPABILITY OF G.E.'s AIRCRAFT PRODUCTS DEPARTMENT ASSURES READY-FOR-ACTION SYSTEMS



COMPLETE TAIL TURRET PACKAGE, made up of G-E radar computer and gun turret, is assembled for shipment to Douglas for incorporation into B-66 airframe.



FIRE TESTING of assembled tail turret in indoor range assures delivery of "combat ready" defense system for the aircraft's first flight.

SERVICE ENGINEERS help Air Force attain maximum armament maintenance standards, provide G-E designers with field data to speed improvements.

GENERAL ELECTRIC ARMAMENT SYSTEM gives B-66 gunner automatic warning of an intruder, split-second analysis and positioning of guns with correct lead for a kill.

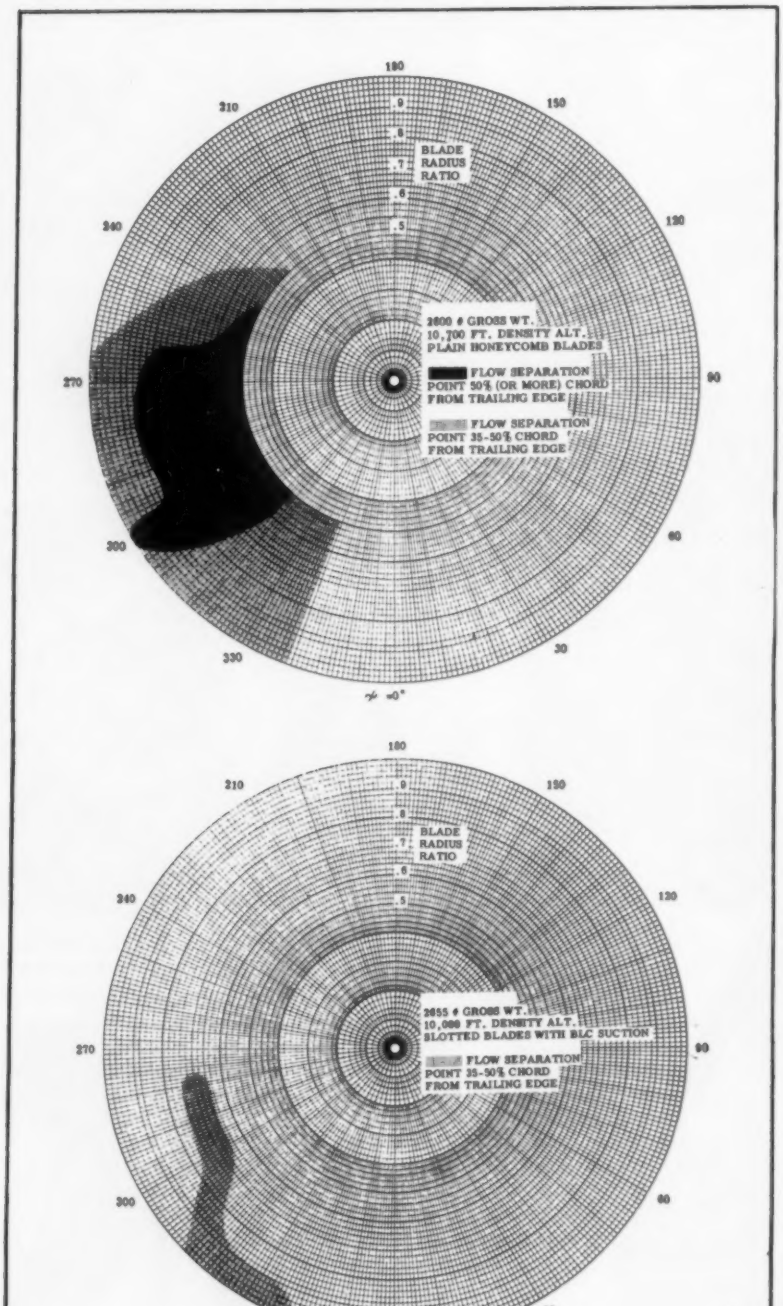
Boundary Layer Control Aids Helicopters

By Robert H. Cushman

Boundary layer control can extend the high speed limits of helicopters—this has been proven by CH-1 flight tests, according to S. H. Hinton, engineer for Cessna Aircraft Co., Helicopter Division.

Sucking air through slots in a modified CH-1's rotors verified that a helicopter was able to fly at least 13% faster than its ordinary upper speed stall limit. The roughly 11 mph. gain was at only 7% cost in weight for the boundary layer control (BLC) system. Power limitations and drag penalties of the test vehicle prevented Cessna from finding out fully how far the increase in top speed could be carried out.

The gains would have been even greater in a helicopter designed to take advantage of the BLC, Hinton told a recent American Helicopter Society Meeting.



LOOKING DOWN on the planview of the area swept out by the rotors, these plots show the degree to which the flow separated at each helicopter's maximum speed. Where the upper non-BLC rotor had fully stalled (black spot) near 300 degrees azimuth, the BLC rotor showed only grey areas of less than 50% separation.

Problem

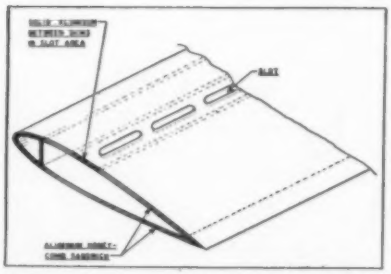
As a helicopter moves faster and faster into forward flight, the forward swinging rotor finds itself biting into the air faster. But the rearward swinging rotor on the opposite side finds itself going through the air slower. To counteract this addition and subtraction of flow on the opposite sides of the rotor, helicopters have been feathering out or flattening the angle of attack on the advancing side and increasing the angle of attack on the retreating side.

This angle of attack difference between the advancing and retreating blades must increase as the forward speed increases. At some forward speed, the retreating blade is forced into an angle of attack exceeding the critical stall angle of the airfoil and the blades periodically stall as they go around into the retreating side. This causes, as might be expected, severe vibration, requires more horse power and can even result in loss of control for the helicopter.

BLC Solution

Cessna delayed the retreating blade stall at high angle of attack by sucking off the low energy boundary layer as it formed on the upper surface of the rotor before it could build and separate, such separation of course being synonymous with stall. They did this by pumping the air out of a hollow rotor blade with a long slot on the upper blade surface.

When the suction slots were used on



THE BLC test rotor blade used a hollow honeycomb skinned trailing section.

the 2-blade, 2,600 lb., 260 hp. Cessna CH-1 helicopter, the 190 lb., 50 hp. suction system enabled the CH-1 flying at 10,000 ft. to increase its top speed from 87 to 100 mph. without stalling.

Even at the upper limit to which the test helicopter's powerplant would push it, the amount of rotor chord stalled was only 35% measured from the trailing edge. And since Cessna has defined stall as 50% of the rotor chord separated (because at 50% the lift falls off sharply), it was felt that a CH-1 with a better hp./drag ratio than the test vehicle could have pushed further up in speed without stalls.

Test Hardware

Two test vehicles were used. One a Cessna CH-1 helicopter with the special BLC rotor blades and pumping system and the other a regular CH-1 but with similar rotor blades (though unslotted) for comparison.

The CH-1 was chosen not only because it was available to the Cessna engineers but because it was able to get up to an altitude where forward speed is normally so curtailed by the thin-air tendency of the blades to stall, that BLC could be demonstrated without going to a helicopter of special design.

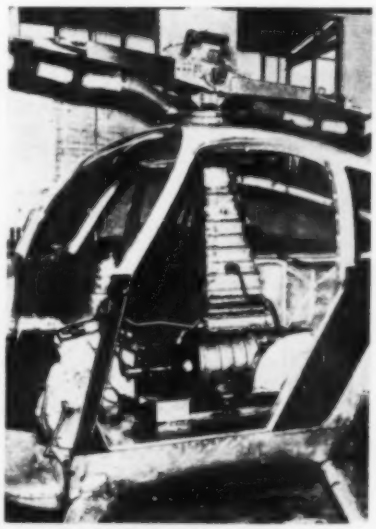
The slotted and the control blades were both manufactured by the Prewitt Aircraft Co., Clifton Heights, Pa. They were constructed with ¼ in. aluminum honeycomb replacing the standard CH-1 blade's corrugated aluminum substructure. The BLC slotted pair had slots made up of 3 in. long sections with ½ in. structural bridges between, placed at 27.5% chord. The slot width appears to have been near .015 chord. They started half way out along the rotor and stopped at .94 radius because the outer 6% of the blade was found not to be contributing significantly to the BLC effectiveness.

The air was sucked from the hollow rotor blade via a flexible length of hose near the blade roots and by a Cessna-designed lightweight rotary-vane fixed-displacement pump. Both ends of the system were valved off so that there would be no back flow. On the rotor end, rubber flaps prevented the centrifugal force along the rotating blades from drawing air out during the off portion of the cycling valve. A hinged door at the BLC pump overboard dump prevented back flow when the pump was not engaged.

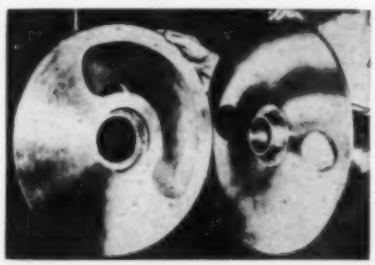
Hinton pointed out that the centrifugal force which might be thought to favor blowing BLC, rather than sucking BLC, actually impartially helps both because it subtracts momentum in the case of suction BLC, and aids the pump in the case of blowing BLC.

The rotary coupling which transmitted the flow from the whirling rotor to the stationary duct leading down to the pump, performed the dual function or not only acting as a rotary coupling but as a cycling valve as well. It was made to pull air from the rotors only during their rearward sweep from 234 to 326 degrees azimuth.

As mentioned, the pump was designed by Cessna. Hinton said that after deciding that a fixed displacement rotary vane pump was best for the job they found that nothing but heavy duty industrial items were available. They therefore designed a 1,030 cu. ft. per min., 2.7 compression ratio, 12 in. dia., 27.5 in. long rotary vane pump which weighed only 144 lbs. Its six phenolic-asbestos vanes rotated at 1,500 rpm. The entire BLC system weighed 190 lbs. but took 50 gross net hp. to do 18½ net hp. of pumping.



A PUMP installed on the cabin floor pulls the flow through rigid and flexible ducts and a rotor valve from the blades.



HALF OF rotor head valve revolves with rotor to cycle boundary layer suction flow from blades.

Flight Tests

Cessna made 34 test flights at 10,000 ft. The basic test data was obtained by motion picture flow-indicating studies of tufts glued to the rotor blades. The motion picture cameras were attached on top of the rotor hub so that they followed the blades around and obtained a continuous picture of what the BLC was doing to the flow over the rotor blades. Depending on the amount of agitation of the tufts, Cessna was able to determine how far the stall separation had progressed from the trailing edge.

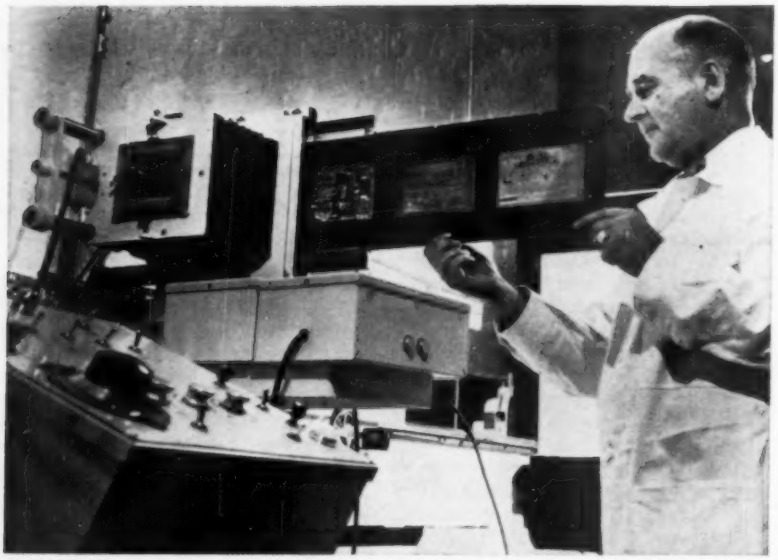
Although this research was directed specifically towards extending the lift curve to delay the retreating blade stall on forward flight, Hinton said that other types of BLC could be designed for other uses on helicopters. For example, the effect could be used to stabilize the laminar boundary layer for drag reduction to reduce power requirements (this might be attractive on flying cranes) or with trailing edge slots as a primary means of helicopter flight control.

Cessna worked into their BLC program with modest wind tunnel tests in the 4 ft. non-return tunnel at the University of Wichita. An oscillating drive was used to cycle the angle of attack of the airfoil in the two-dimensional test set-up to partially simulate helicopter forward flight. Meanwhile, a stroboscopic light source stopped tufts on the foil and an electric integrator system gave oscillograph recordings of the pressure against the other variables.

During the wind tunnel investigation, blowing BLC was eliminated because of the large pitching moments it introduced. Porous suction areas instead of slots were also eliminated because it was felt that the low fatigue strength of porous materials would pose "formidable" structural problems.

The NACA airfoil sections were investigated: 0015, 63$_2$-015 and 6-H-15. Hinton's group found that the large nose radius of the NACA 0015 airfoil section was the most responsive to the stall-delaying effect. So far as slot location was concerned, though the chordwise position did not effect the BLC efficiency, it did effect the pumping power—increasing the power required as it moved forward to the leading edge.

Sikorsky is also studying helicopter BLC. What benefits BLC could have in extending the high speed of one of Sikorsky's inherently fast helicopters will be interesting to see.



NEGATIVES for projection of drawings are mounted in carriers that slide into position successively for enlargement by Micromaster Camera. Control panel is capable of timing exposures to the nearest tenth of a second.

Service Offers Larger Negative For Better Drawing Reproduction

Engineering drawings are reduced to 105 mm. film for storage and enlarged again with better quality than the originals by a recently started service which will soon be available in 40 major cities in this country and one in Europe. The service will be available to users whose volume of drawings would not justify purchase of equipment for comparable work.

TWA has placed an order with the new service, operated by Keuffel & Esser Co., to reduce all 30,000 engineering drawings for their new Lockheed 1649 Super Star Constellations. Storage space for the negatives will be 15 sq. ft. Blueprints would require 392 sq. ft. Similar orders are being considered by TWA for their Boeing 707 and Convair 880 jet liners.

High Cost

Because of the high cost of equipment for the 105 mm. "Micromaster" technique, K&E officials expect that users will prefer to use the service rather than buy and operate their own equipment.

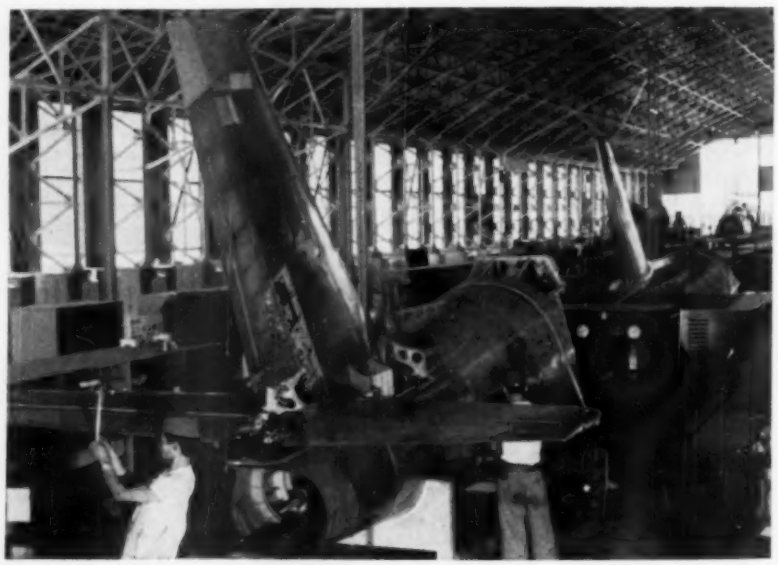
The 105 mm. technique is believed to be a better compromise between requirements of minimum storage space and high quality blow-up than earlier 35 mm. microfilm and 70 mm. photographic reduction systems. Based upon the 10 diameter limit on efficient photographic reduction generally accepted by the experts, the 105 mm. system can maintain the quality of a larger drawing than the small film systems. Reductions of greater than 10 diameters bring line thickness too close to film grain size and result in a grainy blow-up and loss of detail.

For drawings up to 36 x 54 inches in size, the new service can actually improve the quality of a reproduced transparency by as much as 75% over the original. This is possible because film, camera, projector and technique have been specifically designed for line reproduction rather than adapted from systems intended for tone reproduction. Another factor in quality improvement has been the de-emphasis of cost considerations made possible by the service approach. The optical designs chosen have long been known but have been commercially impractical when based on a product sales approach.

Specialized photography yields quality not to be had by non-photographic methods because these generally rely on the passage of light through the original. This picks up sub-surface flaws and surface distortions and dirt on both sides of the original. Photography by measuring only reflected light escapes all but the flaws on the first surface and most of these can be washed out by using a projection method which is capable of picking up only a small range of tones. Also, silver compound lines in a photo are darker and sharper than lines in a pencil tracing.

Negatives meet Bureau of Standards requirements for archival quality which is described as durability without impairment for 100 years or more. For photo negatives this requires limiting the amount of developer retained in the emulsion to less than .005 mg. per square inch.

The 105 mm. technique was devel-



Mitsubishi F-86s

North American F-86s are assembled by Japan's Shin Mitsubishi Heavy Industry with engines and parts obtained from the United States. Mitsubishi is expected to assemble 300 F-86s by July 1958, and in due time to manufacture its own jets.

Judge a Product by its Users

Proud achievement of advanced design and engineering is Lockheed's F-104A, world's fastest combat plane. Among the components contributing to "years ahead" performance are Aeroquip 601 Lightweight Engine Hose and ***"little gem"*** Fittings used for fuel, oil and pneumatic lines.

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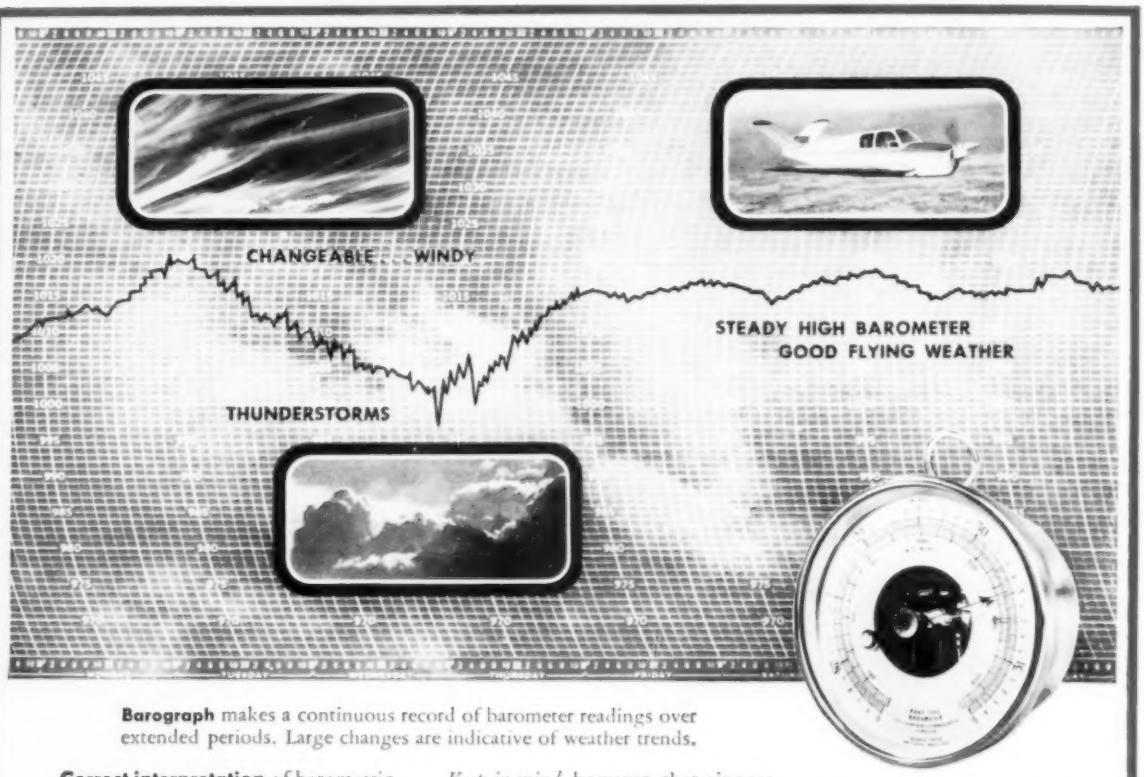
Mobil — **FLY WEATHER-WISE**

These weather items prepared in consultation with the United States Weather Bureau

BAROMETRIC FORECASTING



Barograph makes a continuous record of barometer readings over extended periods. Large changes are indicative of weather trends.

Correct interpretation of barometric behavior can be a valuable aid in forecasting weather. As pilots know, a falling barometer indicates the approach of a low pressure system with associated bad weather. High winds can generally be expected when barometer rises or falls rapidly. Upturn indicates a windshift and improving weather.

Keep in mind, however, that air pressure normally goes up or down with daily rotation of the earth. Thus, atmospheric pressure is highest at around 10 A.M. and 10 P.M. Lowest at around 2 A.M. and 2 P.M. So a falling barometer between 10 A.M. and 2 P.M. does not necessarily indicate approach of a storm.

Aneroid barometer can be used to make your own generalized forecasts if record of readings is kept. Reset fixed reference hand frequently to keep track of pressure changes. Gentle tap will show if immediate trend is up or down.

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Mobilgrease Aero General Purpose, with a temperature range of –40°F. to 275°F., is recommended for normal conditions to help assure instantaneous reaction of ailerons, rudder, trim tabs, landing gear and other important controls.

Where low temperature conditions prevail, use Mobilgrease Aero Lo-Temp. It has a temperature range to –65°F. Both of these top-quality Mobil products are approved by leading aircraft manufacturers. Fly weather-wise *with Mobil!*

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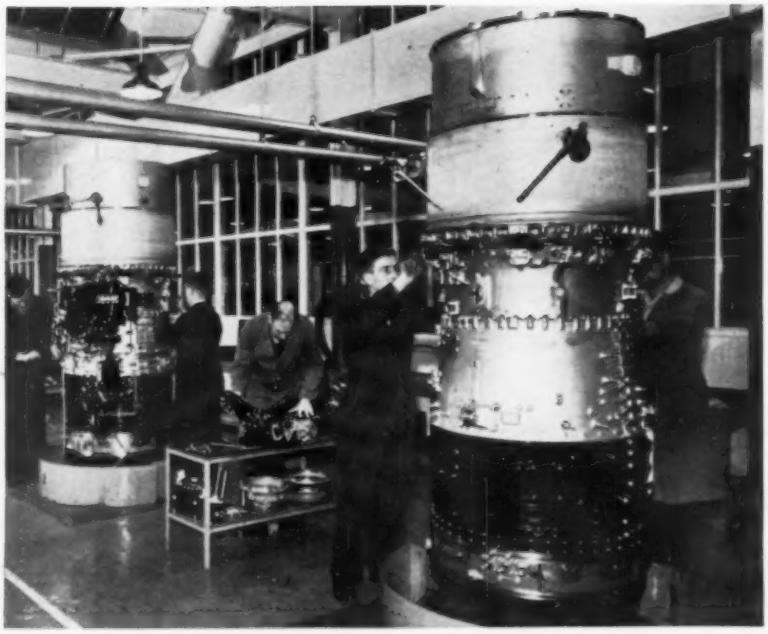


Rolls-Royce Avon

Rolls-Royce Avon RA.29, shown here on assembly line at Derby, England, is scheduled for use on the de Havilland Comet 4 and 4A. Specifically designed for civil airline operations, engine has static thrust of 10,500 lb. and weighs 3,341 lb. Because of low flame temperature Avon RA.29 gives low fuel consumption. Engine is assembled in vertical position on platforms which can be raised and lowered horizontally. Front casing of engine is placed on platform first and as assembly goes on it is lowered into pit for convenience of adjustment and working.

oped by Micromaster, Inc. of Kansas City and K & E Storage space required, while greater than that for 35 mm. microfilm, is still only 4% of that needed for full-size drawings.

It provides an easy means of changing scale. Contact prints can be produced which are useful for identification and in some cases for reference. Reference prints can also be made to quarter or half-size. Service users will be supplied projectors so they can print from negatives at their own convenience. Because of the cost problem these will not offer the same versatility as the big projectors in the service centers but will be a convenient source of reference prints and transparencies. As a time saver, table top viewers will be offered which will project an enlarged image on a translucent screen for reference purposes. Also available is a viewing table which permits making changes on a tracing from the full-size projected image.

Price of the service will be based on number and quality of originals.

Improved Air Speed Indicator Suggested

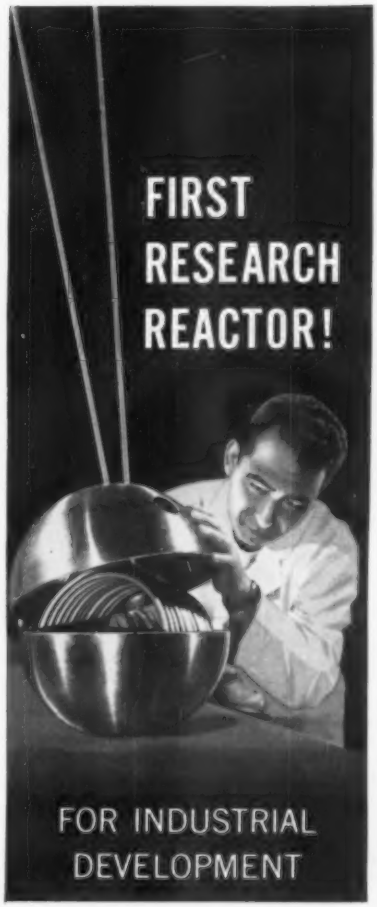
An improved air speed indicator would free pilots of the need to calculate landing speed for widely differing landing weights created by the high proportion of disposable fuel weight to maximum gross weight in heavy jets. Fuel weight may be 40% of maximum gross and its consumption may account for as much as a 50 kt. reduction in landing speed. Miscalculation may cause dangerous overshooting or stalling in the approach.

The improvement was suggested by Squadron Leader B. K. Ghosh, Indian Air Force, an associate fellow of the Royal Aeronautical Society and the Aeronautical Society of India. No manufacturers are known to be considering it.

The new indicator incorporates a fuel gage face with fuel quantities printed next to the appropriate air speed figures. A shutter with a window or a heavily marked pointed is manually adjusted or driven by the fuel quantity indicating system and moves down both scales as fuel is consumed.

For aircraft in which maximum payload is large part of gross weight the concentric fuel scale card is moved in suitable increments to correct landing speed indication for payload variations. The correction is made manually. For a bomber the only conditions likely are empty or with a full load.

In this case, a two position adjustment is adequate.



Peacetime use of atomic energy has become a reality, thanks to the development of the first nuclear reactor designed for private industrial research by Atomics International, a division of North American Aviation.

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AIRBORNE FINGERPRINTS

— new air traffic safety by Stewart-Warner Electronics

Now, the new Stewart-Warner Electronics Airborne Safety Beacon makes it possible for every plane in the air to carry identification as positive as your own fingerprints. Stewart-Warner Electronics, the pioneer and builder of the first airborne safety beacons, which were tested by the Air Navigation Development Board and CAA, now offers airline and other aircraft owners automatic identification for greater air traffic safety.

The new beacon combines all the reliability and long-life factors of airborne military equipment supplied by Stewart-Warner Electronics to the services since 1942. This rugged equipment incorporates ARINC tubes and is designed to meet specifically characteristics No. 532-A.

CAA is now planning to install interrogators on ASR radar at all major air terminals to improve air safety. Be sure you take advantage of this program by installing an S-W Electronics Air Safety Beacon. Write today for full details from our Civil Aviation Department 14. Stewart-Warner Electronics, 1300 North Kostner Avenue, Chicago 51, Illinois.

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Beryllium Offers High Structural Promise

By Irving Stone

Los Angeles—Inherent lightness and strength of beryllium may permit drastic reductions in airframe weight and afford considerable improvement in aircraft performance.

An extensive overall study of the characteristics of beryllium indicates that the metal offers high promise as an aircraft and missile structural material.

For example, here are some advantages seen for a transport plane:

- **Possible airframe** weight reduction of about 50% in comparison with aluminum alloy structures. A beryllium structure would weigh about 40-60% of the conventional metal structure at room temperature, and still show a significant weight advantage up to approximately 1,000F.
- **Range increase** of about 40%.
- **Estimates** are that that the metal's "worth-in-use" to an operator might range as high as $1,000 per pound.

Brittleness

In the face of this promising outlook, there are hurdles to be overcome. Chief among these is beryllium's brittleness, and the fact that the advantages of the metal cannot be realized without improvement in this charcteristic. However, line of research to attack this problem of brittleness have been proposed.

Other deterrents include the metal's high cost, possible scarcity, and toxicity, but these appear less serious.

Evaluation of beryllium for aircraft structures was performed by William R. Micks, Dr. George A. Hoffman, and other scientists of The RAND Corp., Santa Monica, Calif., a non-profit organization conducting research for USAF.

Improvement Sought

A review of the RAND study was presented by Dr. Hoffman at a meeting of the Los Angeles section of the Institute of the Aeronautical Sciences.

Under way for more than a year, the study originated in a search for ways to improve range performance of aircraft. RAND's work focused on new materials. Metallic elements were examined for which adequate information existed on mechanical properties. A logical ordering was developed relating element atomic number with the weight of structures that might be made of the material. This ordering showed that there are many metallic elements with lower atomic numbers than aluminum, today's conventional aircraft metal, and of these elements beryllium makes the lightest structure.

Low Density

Properties of beryllium favoring it above other metals for structural use range from a very low density (same as magnesium) and very high modulus of elasticity (1½ times that of steel) to a great potential strength, it is reported. One qualification is that today's beryllium is not ductile enough for most uses to which it might be put.

Strength and modules of elasticity of the metal at elevated temperatures, as considered by the study, are the highest values exhibited by a pressed-powder extruded beryllium produced by Brush Beryllium Co. in 1955. It should be noted, Hoffman points out, that considerable variation in strength is typical of the metal, because of its sensitivity to the method of production.

Continuing growth of the strength of metals in general within the past few years has been paralleled by the improvement in the strength of beryllium in the last decade, Hoffman points out.

This trend has caused much speculation that future alloys of beryllium may have higher strengths than the best present metal. On the other hand, he says, in predicting the elongation of the metal in the future, it is uncertain whether the elongations obtained at present can be significantly improved.

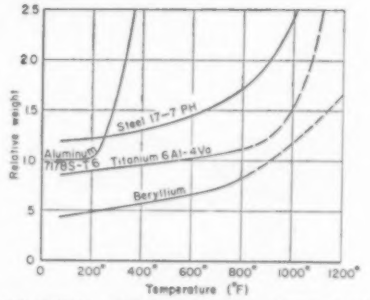
In the structural evaluation of beryllium, it is compared with 7178S-T6 aluminum alloy, 17-7PH steel and 6 Al-4Va titanium alloy on a weight basis for equal strength structures, considering tension and compressive buckling loads over a range of temperatures.

These comparisons assume that the beryllium has sufficient ductility for use in airframe structures and that the best beryllium today will be representative of the best beryllium alloys available in the future.

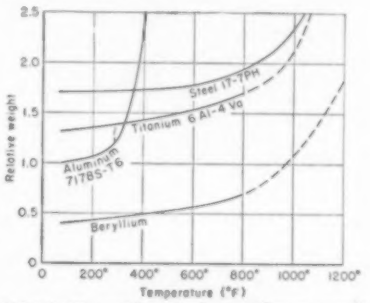
Weight-Strength Ratio

Comparing structural elements designed for tension loads, a weight-strength ratio comparison with conventional metals shows that a beryllium structure would weigh about 40-60% of the conventional metal structure at room temperature, Hoffman says. Beryllium would still show a significant weight advantage up to temperatures of approximately 1,000F.

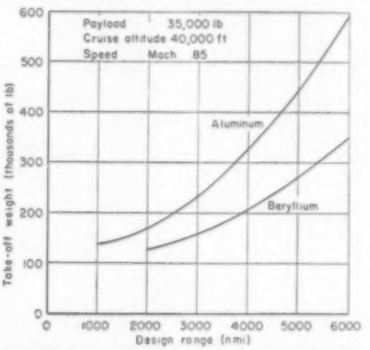
Fatigue and creep properties were not



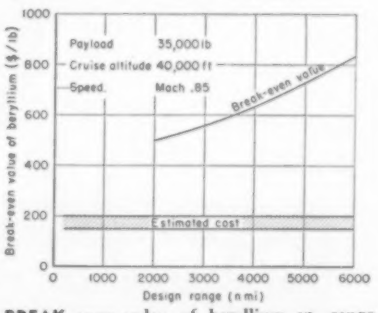
RELATIVE weight of tension elements at various temperatures.



RELATIVE weight of sheet-stiffener panels at various temperatures.



TAKEOFF weight vs. design range for beryllium and aluminum transport planes.



BREAK even value of beryllium vs. range in transport airplanes.

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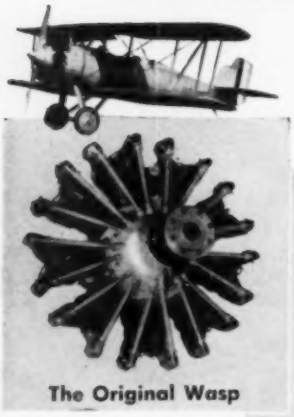

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Beryllium Properties

Mechanical properties reported for Beryllium include: density, .066 lb. per cu. in.; modulus of elasticity, 44 million psi. at 70F, 43 million psi. at 600F, and 26 million psi. at 1,200F; yield tensile strength, 2% offset, 95,000 psi. at 70F, 65,000 psi. at 600F, and 20,000 psi. at 1,200F; ultimate tensile strength, 125,000 psi. at 70F, 85,000 psi. at 600F, and 31,000 psi. at 1,200F; elongation, as hot-pressed, 1-5% at 70F, 8-16% at 400F, 16-34% at 800F, and 10-14% at 1,200F.

included in the comparison because sufficient data on these characteristics of beryllium were not available.

Considering thin-walled elements designed by buckling criteria, the methods of comparison are somewhat more complex than for the case of simple tension. In comparing weight efficiencies of different materials used in thin-walled structures, the most important parameters or characteristics are density and modulus of elasticity. Beryllium is unique in these respects, it is claimed, because it has a low density (.006) and a high modulus of elasticity (44 million psi.).

Complete Comparison

However, a complete comparison must also consider the inelastic behavior of materials, as well as the elastic behavior, it is pointed out. The methods used for this comparison were based on principles of minimum weight design as developed by the structures group at RAND.

The analysis showed that a thin-walled (sheet-stiffener) beryllium structure which would fail by buckling would weigh about 40% that of a structure of conventional metals up to temperatures of about 1,000F.

Thus, it is claimed that with respect to tension and compression elements, beryllium dominates the field of aircraft structural metals in affording far lighter structures. Although beryllium could be substituted hypothetically for other metals in about four-fifths of the structure of a modern transport, there still remains about one-fifth of the weight where beryllium could not be used. On this basis it is calculated that a transport aircraft utilizing beryllium where applicable would weigh about .52 as much as a conventional aluminum structure.

Hypothetical Jet

Hoffman revealed that the study had considered hypothetical turbojet-powered aircraft similar in capability to jet transports being designed for commercial use. Characteristics included design payload of 35,000 lb., Mach .85

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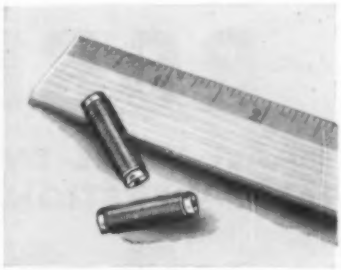

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design cruise, 40,000-ft. initial cruise altitude, fuselage diameter 14.5 ft., length 125 ft., sweepback 30 deg. The beryllium plane is assumed to be made of metal with highest strength obtained in the laboratory today and with elongation and other properties sufficient for structural use but not yet achieved.

With the structural weight of the beryllium transport considered to be .52 times the corresponding weight of the aluminum plane, the beryllium design affords an increase in fuel weight equal to about half the aluminum structural weight. This additional fuel extends the range of the beryllium transport about 40% beyond that of the aluminum counterpart of equal takeoff weight.

Effect on range extension is shown in the graph (p. 57).

This extension of range through use of beryllium is obtained with a material of high installed cost. Hoffman reveals that this installed cost of a finished beryllium structure of the future, after an intensive development program, is roughly estimated to be $150 to $200 per pound, whereas aluminum is usually figured at $20 to $40 per pound installed.

While this cost discrepancy seems excessive it could be offset by operating economies. An operational break-even value for beryllium was computed. This value may be considered as the "worth-in-use" of beryllium to the operator—the amount he would be willing to pay for a beryllium structure to achieve economics in operation over that of an aluminum plane. The study showed that this "worth-in-use" was considerably above the estimated future installed cost for beryllium and increased with range capability.

One-for-Two Use

Since one pound of beryllium will do the work of two pounds of aluminum, the "worth-in-use" should be equivalent to saving one pound of structural weight throughout the life of the airplane, Hoffman points out. Estimates vary on the value of saving a pound of weight, but have ranged as high as $1,000, it is claimed.

The importance of the brittleness problem associated with beryllium cannot be over-emphasized, Hoffman declares, since none of the metal's advantages could be utilized without a solution to this deterrent. It is uncertain whether the ductility of the present-day metal can be significantly improved, and it is not clear that this beryllium ever will qualify as an acceptable structural material.

Hoffman explains that the basic beryllium crystal under tension loads exhibits a fair amount of ductility in some directions but behaves in a brittle manner in others. This results in low values of elongations of the metal. Some success has been achieved in raising the ductility by use of powder-metallurgy techniques. The powdered metal is compacted, extruded and cross-rolled into sheets. These sheets have 30-40% elongation under uniaxial loading in the plane of rolling, and unknown elongation perpendicular to it, he says. There has been no evaluation of this material for aircraft structures.

Avenues of Research

Mentioning possible avenues of research, Hoffman says that reduction of brittleness may result from higher-purity metal, better knowledge of the crystallography, discovery of beneficial alloying additives, or from better production techniques.

Structural evaluation could consist of tests of the best metal for tension and compression stress-strain curves (uniaxial and biaxial), static tests on joined sheets, fatigue tests, short-time and creep tests at elevated temperatures, etc. Built-up structural elements could be assembled and tested in buckling.

A sizeable research effort in the brittleness problem, part of a larger program to make beryllium available for nuclear purposes, has been carried on by the Atomic Energy Commission for

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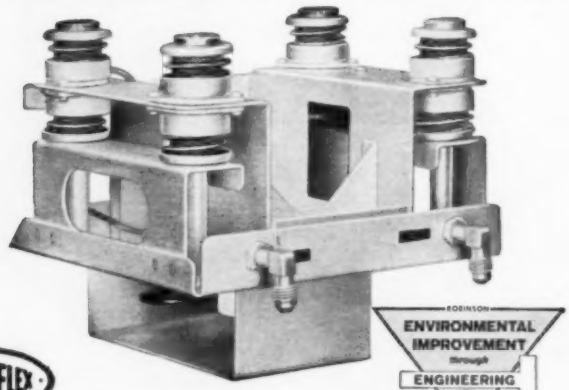

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Transcendental's VTOL

Transcendental Aircraft Corp. has begun pre-flight studies of its Model 2 convertiplane on test apron of its Glen Riddle, Pa. plant. Model 2, built under USAF contract, is expected to fly early next year. It is a high wing monoplane with three-bladed rotor at each wing tip. When rotors are tilted forward it becomes a conventional airplane with a cruising speed of over 140 mph. with 250 hp. engine. Earlier Model 1-G made 100 successful flights during 1954 and 1955. TAC claims Model 1-G was converted up to 90%–90% borne on wings and 10% on rotors. Company says this is maximum conversion so far of tilting rotor convertiplane.

a number of years and has resulted in a vastly improved understanding of the problem.

Powdered beryllium now costs about $100 per pound. Hoffman said manual ore-recovery techniques and low-volume ore reduction of separate batches are the primary contributors to this cost. Economists have estimated, he says, that if continuous production techniques were warranted, significant quantities of cross-rolled sheets might still cost $100 per pound. This cost was estimated for a time period after an assumed development program similar to that for titanium.

One deposit in this country has been estimated to contain enough beryl for 8 million pounds of beryllium as recovered by present techniques. It has been contended that present estimates of beryl sources may be conservative in the light of future knowledge that may develop for ore discovery and recovery. This suggests that there may be enough beryllium to warrant limited use in aircraft structures.

Beryllium probably is the most toxic of the elements, but health hazard controls have been used successfully. The metal is produced today with a safety record comparable to that of a non-hazardous industry, Hoffman says.

Beryllium and its compounds in finely divided form can cause acute lung irritations and skin reactions. Grinding and machining must be performed under ventilated enclosures. However, massive forms of the material are almost harmless because not enough of the metal rubs off to be of any consequence. Structural shapes, therefore, will be able to be manipulated with unprotected hands.

PRODUCTION BRIEFING

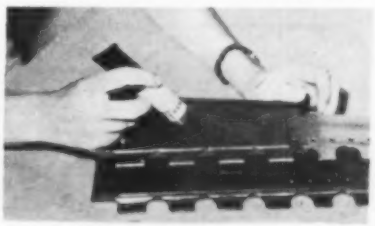
Moore Development Co., Torrance, Calif., is a new firm which founder Joseph H. Moore said will specialize in experimental and prototype fabrication of aircraft components and environmental testing for major aircraft manufacturers. Moore resigned as head of the experimental department of Pastushin Aircraft Corp. to found his new company.

Nacimco Products, San Diego, Calif., is the result of the merger of two small San Diego machine shops plus engineering talent from two of the larger West Coast firms, Convair and Boeing. The two firms which provide the backbone for Nacimco are National City Machine Co. and San Diego Machine Co. R. G. Greenbaum, W. Don Howell and J. L. Shumway, chief engineer, general manager and research physicist respectively, are from Convair. James E. Elliot, design engineer, is from Boeing. The 45-man firm currently is manufacturing an airborne telemetering tachometer and a fast response temperature transducer. Plans are being made for rapid expansion to over 100 employes. Work will be in precision aircraft tooling as well as advanced instrumentation.

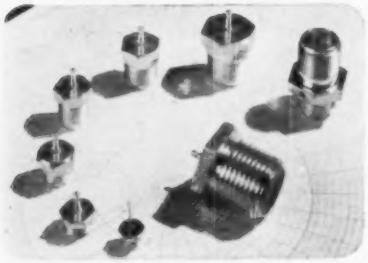
American Silver Co., Inc., Flushing 54, N. Y., is precision-rolling all members of 300 and 400 series stainless steels down to .0005 in. for honeycomb cores and other uses. Claiming tolerances of plus-or-minus .0001 in., the company said it undertakes quantities from one pound to several tons.

National Bureau of Standards says it has successfully electrodeposited chromium protective coatings on titanium by first forming a titanium fluoride film, electroplating with chromium and then heat-treating to 800C.

Everlube Corp., North Hollywood, Calif., claims that its "Tempa-Dot"



SPECIALIZED EXPLOSIVES



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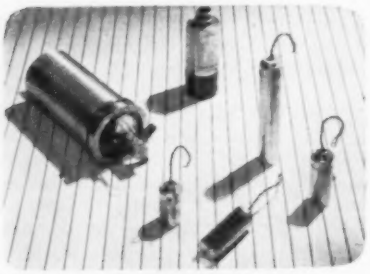

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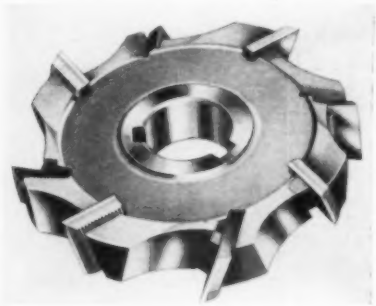

gered tooth-clotting cutters for use on aluminum and other light metals. They range from $\frac{3}{8}$ in. to 2 in. wide and from 4 in. to 16 in. dia.

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shaft. Called Nylatron "GS," the material is stated by the maker, National Polymer Products, Reading, Pa., to allow the pump to operate against 1,300 psi. or run dry as long as 100 hrs.

Joseph T. Ryerson & Son, steel distributor of Chicago, claims that abrasive cutting of stainless steel, as against shear cutting, produces a close tolerance, smooth-side cut. The abrasive cutting machine used by Ryerson is made by the Ty-Sa-Man Machine Co., Knoxville, Tenn. It can handle stainless steel plates up to 12 by 25 ft.

Tapered Air Products Corp., Lynwood, Calif., received $400,000 in F-102A subcontracts from Convair Division, General Dynamics Corp. Tapered Air will produce sculptured structural components such as wing skins and doors.

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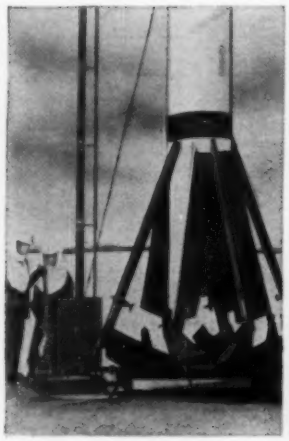

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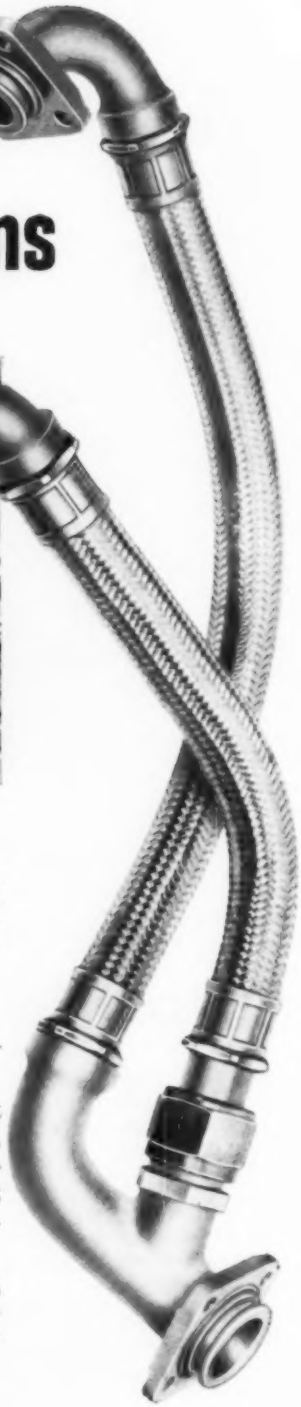

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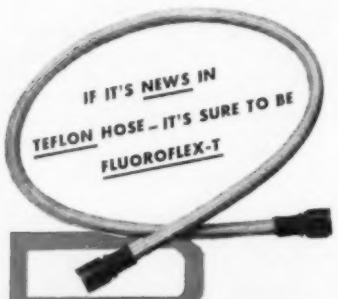

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De Havilland Delivers CS2Fs

Initial deliveries were made recently of CS2F-1 Trackers built by de Havilland Aircraft of Canada under license from Grumman Aircraft Engineering Corp. The anti-submarine airplanes have Royal Canadian Navy markings. Tooling was begun in May 1954. Delivery was on schedule although a strike in 1955 resulted in a four month production interruption.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

ROME AIR FORCE DEPOT, Griffiss Air Force Base, New York.

Eastman Kodak Co., 343 State St., Rochester 4, N. Y., film, 9½"" x 370', type 1B, class L, 500 roll; film, filters and chemicals, for serial color photo, 100 set; film, 20" x 24", type VIID, class E, 100 pkg., (RFP 30-635-56-4499Q), $58308.

Rome Cable Corp., Ridge St., Rome, N. Y., wire, elec. standard 0000AWG in A/W MIL-C-5756B, 36000 X fee, (IFB 30-635-56-398B), $29844.

Bendix Aviation Corp., Bendix Radio Division, East Joppa Road, Towson, Md., AN/CPN-18A radar set bench mock-up, 4 ea., (RFP 30-635-56-4559Q), $416085.

AIR FORCE MISSILE TEST CENTER, Patrick Air Force Base, (ARDC), Fla.

Cubic Corporation, 2841 Canon Street, San Diego 6, Calif., fabrication of three (3) single base line sets of COTAR direction-cosine measuring equipments and installation in trailer type vans, (P. R. no. FP-1 (56)-454), job, $226391.

Milgo Electronic Corp., 7601 Northwest 37th Ave., Miami 47, Fla., code generators, 14 ea., (P. R. no. FP-(56)-47), $51388.

Century Electronics Co., 34 Oleander St., P. O. Box 648, Coca, Fla., recorder system model 1122, 14 ea., (P. R. nos. FP-1(56)-472, FP-1(56)-476), $42532.

Mitchell Camera Corp., 666 West Harvard St., Glendale 4, Calif., motor, 2900-535550, 13 ea., Camera, 2900-NL120380-6, 13 ea., case, 2900-NL121397-52, 13 ea., case, 2900-NL121416, 13 ea., case, 2900-NL121418, 13 ea., magazine, 2900-NL511114-5, 52 ea., magazine, 2900-NL51114-75, 52 ea., motor, 2900-NL527954, 13 ea., (P. R. nos. 10DII-LP56-276, 10D-II-LP-56-277), $68321.

Bell & Howell Co., 7100 McCormick Rd., Chicago 45, Ill., blower & air filter motion picture, 2900-NL101927-65, 1 ea., blower and air filter, 2900-NL101927-75, 1 ea., fade & dissolve attachment, 2900-NL278947-635, E ea., fade & dissolve attachment, 29001NL278947-75, 1 ea., printer, 2900-NL699430-835, 1 ea., printer, 2900-NL699-433-65, 1 ea., table, 2900-NL828849-75, 1 ea., picture head, 2900-NL684488-75, 1 ea., picture head, 2900-NL684488-7, 1 ea., P. R. no. 10D-II-LP-56-22012), $32712.

Zenith Aircraft, Division of Zenith Plastics Co., P. O. Box 91, Gardena, Calif., teledome, 12 ea., (P. R. no. FP-1(56)-430)*, $62908.

Mitchell Camera Corp., 666 West Harvard St., Glendale 4, Calif., 16 mm camera and accessories, 48 ea., (P. R. no. FP-1(56)-385), $284948.

Applied Science Corp., of Princeton, Box #44, Princeton, N. J., multicoupler, 1760-NL531530-5, ea., preamplifiers, 1760-NL698-666-56, 4 ea., preamplifier, 1760-NL69866-58, 22 ea., (P. R. nos. AF 16M-IV1LP-21291, AF 16M-IV-LP-56-21292), $47060.

Electronic Engineering Company of California, 180 So. Alvarado St., Los Angeles 57, Calif., CZR timing units and auxiliary equipment, 10 ea., (P. R. no. FP-1(56)-374), $65179.

Electronics Associates, Inc., Long Branch, N. J., computers, servo, model 484-B, 8 ea., (P. R. no. FP-1(56)-444), $163430.

DEPARTMENT OF THE AIR FORCE, Headquarters U. S. Air Force, Air Force Academy Construction Agency, P. O. Box 1670, Colorado Springs, Colo.

Boeing Airplane Company, Wichita, Kan., trainers and engineering changes (PR PA-210556 and PH-669550), $501728.

Jack & Heintz, Inc., Cleveland, Ohio, starters, A/C, direct cranking, P/N AN4116R3B, 306 ea (PR PE-670602 &

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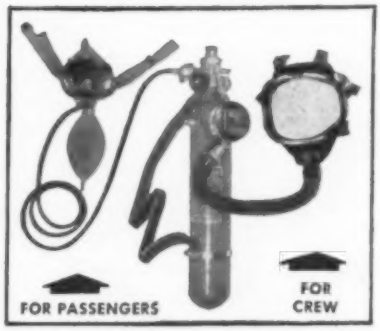

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(Advertisement)

Valve Talk

FOR WM. R. WHITTAKER CO., LTD.

BY MARVIN MILES

Bill Moore looks more like a Hollywood leading man than an engineer, but a glance at his desk tells the true story.

It's littered with paper and each sheet is filled with geometric figures, arrows, mathematical calculations and terse, printed explanations.

In the desk drawers various sets of small assembly tools lie ready for use, for Bill not only dreams up new valves, he puts them together once the components for a pilot model are delivered.

Whittaker's assistant to the Vice President of Engineering, and one of the real veterans of the company, Moore, at 44, has more hair than any two men his age and it's slightly streaked with silver in the thespian manner.

But Bill's no actor. He's as straightforward as they come. And he lives and breathes valve design.

A native of Oak Park, Ill., he attended Marquette University for two and a half years, completing the basic engineering course before the depression ended his formal training.

Assistant to the Vice President of Engineering

Interested in sailing since boyhood, he and a friend went into boat design and building where he applied his engineering knowledge to the production of a series of small sail craft and worked up eventually to a 30-foot auxiliary.

But the depression worsened and Bill found it expedient to find work as a draftsman for Allis Chalmers at $12 a week. Three years later he left to go with International Harvester where he was employed as a design engineer until he joined Lockheed in 1940.

His talent was quickly recognized and he was assigned to design work on Constellation controls. Sometime during the three years Bill was with Lockheed he met Bob Whittaker who was then just starting the Whittaker Co. and Moore agreed to help out by doing valve design for the fledgling concern on a contract basis in his spare time.

Then, in 1943, he decided to cast his lot with the little valve company and went to work for Bob in "Plant No. 1," a former real estate office where he designed units for production in nearby "Plant No. 2," a converted garage.

Bill's work today is the design of new valves and he's a genius at it, utilizing abstract principles that many times are clear to no one but himself in the beginning. Only rarely does he work from specifications.

His procedure is to come up with an original idea for a unit that can be of value to Whittaker because it is of value to the industry.

With the basic idea in mind, he starts filling innumerable sheets of paper with figures and free-hand sketches, modifying the concept, refining it, working the unit together.

Bill doesn't work on the trial-and-error "breadboard" prototype principle. Instead, to save time and money, he fights the whole idea out on paper to the point where he can deliver accurate diagrams (although far from formal draftsmanship) and precise tolerances to experimental production.

Then, when the components are finished – and they may well include a special Moore-devised actuator – they're delivered to Bill and he does the initial assembly work.

Once he's satisfied with a unit it goes to qualification test after which Bill turns it over for cost analysis and production engineering.

Primarily, Bill evolves pneumatic and fuel valves and actuators, although his experience is so extensive he now and then comes up with developments in other fields – even outside his work for Whittaker. He has designed an electric-powered catamaran and he's now up to his ears in a Three-D project.

In addition to new designs, Bill's specialty is small packages and he prefers to strengthen weak points and keep the envelope small rather than start out over-strength and be saddled with an unnecessarily large package.

He works with specialists, of course, such as metallurgists, but they'll tell you it's surprising how much Bill knows of their special fields.

And he studiously follows all developments in metals, synthetics, etc., looking for anything that can help in the creation of new, smaller, more efficient valves or the improvement of designs already in production.

"It's rougher to come up with new ideas today," he says. "In the past you could sort them out and pick the one you wanted to work on, but no more!"

Bill's record speaks for itself – hundreds of ideas turned into metal with many more coming.

MIPR R56-8412-TCSMC-03-C), $66747.

Radio Corporation of America, Engineering Products Division, Camden, N. J., receiver-transmitter RT=128A/ARC-21, 380 ea., power supply PP-298/ARC-21, 1081 ea., radio set control C-451A/ARC-21, 838 ea (PR-670764), $6333985.

Fairchild Camera & Instrument Corp., Robbins Lane, Syosset, Long Island, N. Y., control, operating navy type C2R-1A, 200 ea., publications, (MIPR 56-2414-142-AER), $38414.

Boeing Airplane Company, Wichita, Kansas, phase V ECM capsules and static test capsule for RB-47E airplanes 50 ea (PR PA210556, PH236564, PH 205172, & PH 205193), $6937999.

Boeing Airplane Company, Wichita, Kans., trainers (PR PH-143341), $33562.

Boeing Airplane Company, Wichita, Kans., 40 KVA alternator and constant speed drive trainers 16 ea (PR PH-205174), $405343.

McDonnell Aircraft Corporation, Lambert Field, St. Louis, Mo., misc engineering changes and flight simulator requirements for F/RF-101A a/c (PR PH-636239 and PA-226847), $369307.

Boeing Airplane Company, Seattle 14, Wash., extension of flight test program—KC-135 aircraft program (PR PH-143468), $4453365.

The Glenn L. Martin Company, Baltimore, Maryland, modification of government owned armament and special weapons trainers (B-57B-2 B-57B-3, and B-57B-4) versions 3 ea (OR PH 709632), $40458.

The Glenn L. Martin Company, Baltimore, Md., B-57E aircraft rudder boost system trainers 2 ea (PR PH-564612), $28750.

Link Aviation, Incorporated, Binghamton, N. Y., aircraft target and reel control system trainers for B-57 MTU's 2 ea (PR 671178), $474847.

North American Aviation, Inc., Los Angeles International Airport, Los Angeles 45, Calif., ships sets of F-86-K airplane parts, components, and equipment 45 ea (PR 671792), $4000000.

North American Aviation, Inc., Los Angeles International Airport, Los Angeles 45, Calif., modification of F-100-1 and F-100-2 (PR PH-235915), $416118.

Burton Rodgers Technical Training Aids, Inc., Cincinnati, Ohio, cockpit procedure trainer for T-33A aircraft; 33 ea spare parts maint data, to be used on training devices, (PR PH-235960), $842713.

Aero Design and Engineering Company, P. O. Box 118, Bethany, Okla., L-36C airplanes, spare parts, ground handling equipment, spare engines and data 4 ea (MIPR #R-56-614-TC and amendment #1, 2, and 2), $452256.

Remler Company, 2101 Bryant Street, San Francisco, Calif., radar and microwave panel sets for console OA-650/GSQ-T2 ultrasonic circuit panel sets for console OA-650/GSQ-T2, synchro panel sets for console OA-650/GSQ-T2, (PR 00-217136 and 990543233), $683698.

SAN ANTONIO R&D PROCUREMENT OFFICE, Air Research and Development Command, P. O. Box 63, San Antonio, Tex.

The Regents of the University of California, Los Angeles, Calif., research for study of variables in problem-solving and trouble shooting (contract AF 41(657)-52), job, $32749.

Institute of Andean Biology, Lima, Peru, research and reports on mechanisms of natural acclimatization, (contract AF18-(600)-174), job, $75453.

General Motors Corp., AC Spark Plug Div., Flint, Mich., plug, spark, AC, 4708-LA (PR 03H-R-56-8912 and R-56-8912-1 TCS-MC), 37340 ea, $72813.

Mid-State Construction Co., P. O. Box 13206, Dallas, Tex., installation of fixed radio and radar facilities at TM-186, Pyote, Tex. (IFB 41-608-56-244), job, $33680.

SACRAMENTO AIR MATERIEL AREA, McClellan Air Force Base, Calif.

Whirlpool-Seeger Corp., St. Paul Division, St. Paul 6, Minn., P/N 5619-161-48329-51, fin assy, F86 A/C, 90 ea, P/N 5619-17604-8307011, post, 450 ea, P/N 5619-191-4825-

fin assy, 276 ea, (PR 966), $55667.

Consolidated Diesel Electric Corp., Ludlow & Canal St., Stamford, Conn., P/N 8211-235-1100 wheel, 5 ea, P/N 8211-293-0650 interconnecting box, 50 ea, P/N 8211-293-2150 box assy, 30 ea, applicable MD-3 generator sets, (PR 5241), $103480.

MEMPHIS AIR FORCE DEPOT, Mallory Air Force Station, Memphis 2, Tenn.

Industrial Metal Protectives, Inc., 401 Homestead Ave., Dayton, Ohio, coating, IFB 40-604-56-222, 8000 gal, $64000.

General Motors Corp., New Departure Div., Bristol, Conn., bearings, IFB 40-604-56-324, 15000 ea, $31365.

Stewart-Warner Corp., 1826 Diversey Parkway, Chicago, Ill., lubricating unit, IFB 40-604-56-232, 193 ea, $67576.

Columbia Aircraft Service, Bloomsburg Municipal Airport, Bloomsburg, Pa., engine overhaul, RFQ 40-604-56-14487, 232 ea, $43433.

PURCHASING AND CONTRACTING OFFICE, Stewart Air Force Base, Tenn.

Harold S. Smith & Son, 1831 Columbia Rd., N. W., Washington, D. C., project nrs. SE 81-56, SE 114-56 thru SE 194-56, furnishing and installing local fire alarm systems, IFB 40-602-56-69, contract nr AF 40(602)-403, job, $27500.

GENTILE AIR FORCE STATION, Dayton 10, Ohio, Dayton Air Force Base.

Amphenol Electronics Corp., 1830 S. 54th Ave., Chicago, Ill., handbook of operation and service instructions in a/w Spec MIL-H-795A dtd 5 Feb 53 covering air-portable test bench groups, part no. 181-110 model MC-1, illustrated parts breakdown in a/w Spec MIL-B-5005A dtd 17 Aug 51 including amend. 1, dta 16 Oct 52 (RFP 56 3574), $45000.

Aero Precision Industries, 4400 Newcastle Blvd., Oklahoma City, Okla., repair of tests sets, crystal, motors, selsyn, receivers, radio, antenna assys-loop, compass, radio (call 56-12), var quantities, $49025.

Cook Electric Company, 2700 Southport Ave., Chicago 14, Ill., switches, press, relays, thermal, relays, solenoid, relays arms (call 56-5), var quantities, $37489.

93RD BOMBARDMENT WING (H), Castle Air Force Base, Calif.

Stolte, Inc., 8451 San Leandro, Oakland, Cal., construction of sentry dog facility, project castle (56-56) A (Rev 2) Contract AF 04(604)-196, job, $21000.

Ted Bernard, 1305 W. 10th St., Merced, Cal., construction of indoor small arms range, project castle (18-56) A (Rev. 1) Contract AF 04(604)-197, job, $24973.

EGLIN AIR FORCE BASE, Fla.

Sherman Fairchild and Associates, Inc., 30 Rockefeller Plaza, New York 20, N. Y., photographic flight analyzer, with plate holders and mounts (PR 10B-56-967; IFB 08-603-56-461), 3 line items, $25785.

Gulf Power Co., 8-10 N. Palafox St., Pensacola, Fla., electric service for climatic hangar, Eglin Air Force Base, Fla. (Del. order against contract AF 08(603)-254), 5482500 KWH, $61459.

HOLLOMAN AIR DEVELOPMENT CENTER, Holloman AFB, N. M.

Cook Electric Co., 2700 Southport Ave., Chicago 24, Ill., data handling equipment for large walk-in-stratosphere chamber, (AF 29(600)-747), $34032.

Arthur D. Little, Inc., 30 Memorial Drive, Cambridge, Mass., study and development of phosphorus and hydrogen peroxide as a chemical tracking aid, (AF 29(600)-908), $40055.

Holmes and Narver, Inc., 828 Fibuerua St., Los Angeles 17, Calif., research study, (AF 29(600)-886), $61000.

Cook Electric Co., 2700 Southport Ave., Chicago 14, Ill., study and development of load simulation and servo test stand, (AF 29(600)-903), $164000.

Olin-Mathieson Chemical Corp., East Alton, Ill., rocket propulsion system, (AF 29(600)-923), $175779.

Tom W. Heflin, P. O. Box 807, Artesia, N. Mex., shelter for high altitude test chamber, (AF 29(600)-994), $44665.

WRIGHT-PATTERSON AIR FORCE BASE, Ohio.

Helldoerfer-Castellini, 414 W. First St., Dayton 2, Ohio, construction of aeronautical laboratory, substation "F", Area "B" (IFB 33-601-56-605), job, $291069.

A. J. Bayer Co., 2300 E. Slauson Ave., Los Angeles 58, Cal., installation of materials handling system, Bldg 258, Area "C" (IFB 33-601-56-646), job, $138145.

ARNOLD ENGINEERING DEVELOPMENT CENTER, Tullahoma, Tenn.

Hooker Electrochemical Co., Buffalo Ave. at 47th St., Niagara Falls, N. Y., trichloroethylene, stabilized, decreasing spec MIL-T-7003, (IFB 40-600-56-9), 121700 lbs, $13619.

OGDEN AIR MATERIEL AREA, Hill Air Force Base, Utah.

Houdaile Industries, Inc., Buffalo Hydraulics Division, 537 E. Delavan Ave., Buffalo 11, N. Y., 4606-A14847 damper assy, 4606-111796 plate instruction, 4606-1110706, plate instruction, 4606-110704 clamp, (PR-00-787036), $26687.

John Mohr & Sons, Mohr Vacuum Process Div., 3200 E. 96th St., Chicago 17, Ill., chamber assembly, low pressure rectangular stationary 20 main capacity, (IFB 42-600-56-422), $147448.

FluidDyne Engineering Corp., 425 N. 7th St., Minneapolis 5, Minn., target, radar collision course in accordance with Fluidyne Engineering Corp. dwg 00025, (PR 00-543329), 10 ea, $45823.

Otis Elevator Co., Electronic Div., 35 Rayerson Street, Brooklyn 5, N. Y., retrofit kits, spare parts and data (PR 00-543388), 51 ea, $67887.

TOPEKA AIR FORCE STATION, Topeka, Kan.

Aluminum Co. of America, 1200 Ring Bldg., Washington, D.C., aluminum alloy

Season's Greetings from Ryan

To our friends everywhere, we use this means to extend sincerest wishes for a happy holiday season.

This year again, Ryan is following the plan it initiated last year of donating funds normally spent for Christmas cards to help support the excellent work of the relief societies of the Air Force, Army and Navy.

RYAN AERONAUTICAL COMPANY SAN DIEGO, CALIFORNIA

C-130 on Soft Terrain

Lockheed C-130 jumps off soft terrain test field at Eglin Air Force Base, Fla., kicking up dust with its 15-ft. turboprops. The 3245th Test Group, USAF Operational Test Center, put 62-ton airplane through paces on unpaved runways. C-130 has four 20.00-20 tandem tires of relatively low pressure to give more float over soft ground. Forward tires plough and compact the ground, making smoother path for rear wheels.

sheet, 116720 lb, $50889, (IFB 14-604-56-729).

Reynolds Metals Co., Louisville, Ky., aluminum alloy sheet, 91625 lb, $81363, (IFB 14-604-56-812).

Breeze Corps., Inc., 700 Liberty Ave., Union, N.J., clamp, 182000 ea, $25728, (RFP 14-604-56-5238).

Carbide and Carbon Chemical Co., a Division of Union Carbide and Carbon Corp., 30 E. 42nd St., New York, N.Y., ethylene glycol, 99990 gl, $131987, (IFB 14-604-56-790).

Carbide and Carbon Chemical Co., A Division of Union Carbide and Carbon Corp., 30 East 42nd St., New York, N.Y., methyl alcohol, 400000 gl, $107625, (IFB 14-604-56-329).

Geo. Rinner Construction Co., Inc., 4th and N. Lane Street, Topeka, Kans., installation of electronic equipment, 1 job, $129648, (IFB 14-604-56-786).

DAYTON AIR FORCE DEPOT, Gentile Air Force Station, Dayton 10, Ohio.

Cutler-Hammer, Inc., 410 West Erie St., Dayton 2, Ohio, relay, solenoid in a/w spec. MIL-R-6106 B (USAF) dtd 20 Sept. 55 and supp 1A dtd 20 Sept. 55 and AMFA STD dwg AM-3340 dtd 5 Aug 54, 500 ea, (RFP 33-604-56-3841), $33580.

Cannon Electric Co., 3209 Humboldt St., Los Angeles 31, Calif., solenoid, electrical push type Cannon Electric Development Company, Los Angeles, part no. 18538, 2000 ea., solenoid electrical pull type Cannon Electric Development Company P/N 4371, 1200 ea, (RFP 33-604-56-3320), $36924.

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Columbiana, Ohio, surfacer woodworking federal spec. 60-S-811 type 1, class B, 15 ea, commercial data in a/w table IV, photos for above in a/w exhibit "A", 3 sets, (IFB 33-604-56-244 and amdt #1), $92895.

DeWalt, Inc., Lancaster, Pa., saw radial overarm, woodworking in a/w fed. spec GG.G-S-58, type II, style A, size 14 dtd 25 Jan 54, electronic type brake shall be furnished, 99 ea, saw arbor shall be an integral part of motor shaft, 3 sets, saw-radial, overarm, woodworking in a/w fed. spec. GGG-S-58, dtd 25 Jan 54, type II style "A" size 16-L with electronic type brake, 62 ea, (IFB 33-604 56-244 & amendment #1), $114318.

Press Wireless Laboratories, Inc., 25 Prospect Pl., West Newton 65, Mass., voltage divider TS-453/U in a/w spec. MIL-V-4696A (USAF) dtd 23 Feb 55 and electrically and mechanically interchangeable, 34 ea, Vandyke negatives, 1 set, blueline prints, 6 sets, (RFP 33-604-56-3821), $31539.

Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J. , relay 3PST Struthers-Dunn, Inc. type 78CCA101 in a/w General Electric M7470182, 800 ea, (RFP 33-604-56-2758), $60080.

Collins Radio Co., 855 35th St., N. E., Cedar Rapids, Ia., transmitter collins P/N 571-0738-30, 350 ea, (RFP 33-604-56-3381), $28021.

The Parks Woodworking Machine Co., 1501 Knowlton Street, Cincinnati 23, Ohio, saw, band, woodworking, floor mounted parks 18" band saw, 186 ea, (RFP 33-604-56-3258), $60636.

Waltham Horological Corp., 395 Lynway, Lynn, Mass., connector-plug UG-C/U in a/w spec. MS 35168 dtd 17 Apr 53, 90000 ea., (IFB 33-604-56-250), $33300.

Frebank Co., 6441 San Fernando Rd., Glendale 1, Calif., switch-pressure SPST freebank P/N 2050-4A spec no. 38F-38734, 100 ea. switch-press SPST freebank P/N 2050-2A, 200 ea. (RFP 33-604-56-2991), $65879.

Radio Corp. of America, Defense Electronic Products, Front and Cooper Sts., Camden, N. J., microphone dynamic, 30000 ea., (call 56-4), $360000.

Sperry Gyroscoppe Co., Division of the Sperry-Rand Corp., Great Neck, N. Y., items of coil RF, insulators, terminal assy. and capacitor assy, var quanities, (call 56-10), $25523.

Industrial Instruments, Inc., 89 Commerce Rd., Cedar Grove, N. J., test sets insulation breakdown, 273 ea., maintenance spare parts for above, PR. 688813, $39520.

Bruno-New York Industries Corp., 460 W. 34th Street, New York 1, N. Y., multimeter AN/PSM-6, 12 ea, adapter-test contractor's P/N 56-2072, 3000 ea., $42719.

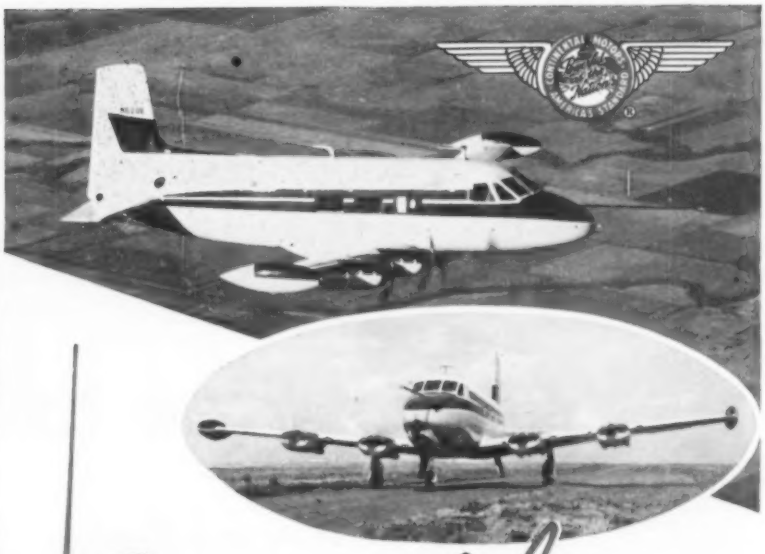
Eastern Plans Miami Hydrant Fuel System

Eastern Air Lines' piston and jet aircraft will be fueled at Miami by a $1,250,000 hydrant fueling system capable of pumping 11,000 gpm. to 22 aircraft loading positions. Construction of the fueling system, which for the most part will be underground, is scheduled to begin in early 1957 under a contract between Eastern and Orange State Oil Company.

The system will consist of underground pipe lines from a 5,000,000 gal. storage area, underground hydrant valve pits at each loading position, and self-propelled hydrant carts carrying hose, gages and filters.

Both wings of an aircraft can be fueled at once.

Eleven DC-8s can be handled at the same time with the system, requiring only nine minutes for the whole operation, Eastern says.



Continental Shares in Another "Aviation First"

. . . CESSNA MODEL 620, WORLD'S PIONEER PRESSURIZED FOUR-ENGINE EXECUTIVE TRANSPORT

Two organizations long noted for their contributions to flying have joined hands to achieve another major aviation "first," Cessna's Model 620, now flying. . . . The Cessna Model 620, world pioneer of its type—first pressurized four-engine airplane built for the corporate market—unites several qualities which users of executive aircraft have long desired. Its four Continental Red Seal GSO526-A engines provide four-engine safety, with the important plus of Continental dependability, economy and service backing. It is pressurized for altitudes up to its four-engine service ceiling of 27,500 feet, and air-conditioned for comfort aloft and on the ground. . . . Flights climaxing three years' work on this advanced airplane have fully borne out its builders' highest expectations. The Cessna 620 now takes its place as the latest on the long roster of fine utility aircraft using dependable Continental power.

Continental Motors Corporation
AIRCRAFT ENGINE DIVISION
MUSKEGON • MICHIGAN

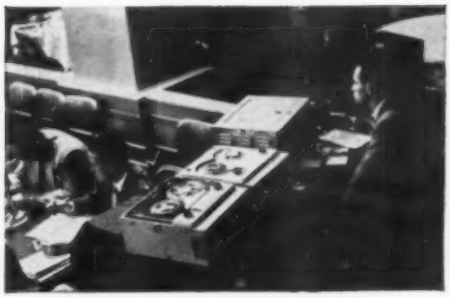
Free Exchange of Ignition Experience

Photo at far left shows a typical conference scene as an airlines representative takes the microphone to ask a question. At right, Richard Teasel, Champion's Director of Research (*with microphone*) speaks for Champion.

Champion's R. K. Christie (*left*), Vice President for Engineering and Research, and Larry Lentz (*center*), discuss series of special reports that noted aviation expert and writer Herbert O. Fisher (*right*) will do for the Champion Spark Plug Co.

87 different organizations from nine nations were represented at the three-day conference, the twelfth annual ignition meeting sponsored by Champion.

Even during the midmorning and midafternoon refreshment breaks, the conversation was shop talk as the participants made the most of this unusual opportunity to exchange ideas and experiences.



Two tape recorders transcribed the questions and answers into a complete report containing a wealth of ignition information that can help solve your ignition problems.

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Capital Airlines
Champion Spark Plug Company
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CIA Mexicana de Aviacion
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Continental Airlines
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DuPont
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Esso Standard Oil
Ethyl Corporation
"Flying" Magazine
Flying Tiger Lines
Frontier Airlines
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General Aircraft—Detroit
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Lake Central Airlines
LaDriere Studio
Lockheed Aircraft Corp.
Lockheed Aircraft Service
Mohawk Airlines
National Airlines—Miami
North Central Airlines
Northeast Airlines
Northwest Airlines
Orenda Engines
Ozark Airlines
Packard Electric
Pan American Airways
Phillips Petroleum Company
Piedmont Airlines
Port of New York Authority
Pratt & Whitney Aircraft
Royal Canadian Air Force (RCAF)—Ottawa
Royal Canadian Navy
Scandinavian Airlines System (SAS)
Scintilla Div. of Bendix
Scott Aviation Corporation
Sensenich Corporation
Shell Oil Company
Shell Oil Company—Wood River Research
Sidney F. Mashbir Company
Sinclair Research
Socony Oil Company
South African Airways
Southern Airways
Sperry Gyroscope
Standard Aircraft Equip., Inc.
Standard Oil Company of Ohio
Standard Products
Texas Company
Trans Canada Airlines
Trans World Airlines
United Air Lines—San Francisco
Vapor Blast Mfg. Co.
Westinghouse
Wright Aero. Div. of Curtis Wright
and
Representatives of the U.S. Army Ordnance Corps, the U.S. Marine Corps, the U.S. Navy Bureau of Aeronautics, the U.S. Air Force, the Civil Aeronautics Bureau, and the Civil Aeronautics Administration.

Sponsored by Champion Spark Plug Company, Toledo conference brings together outstanding ignition experts from 9 nations

For three days in October a group of aviation authorities, representing one of the greatest concentrations of aircraft ignition knowledge and experience ever assembled, met in Toledo and freely exchanged hard-won technical information.

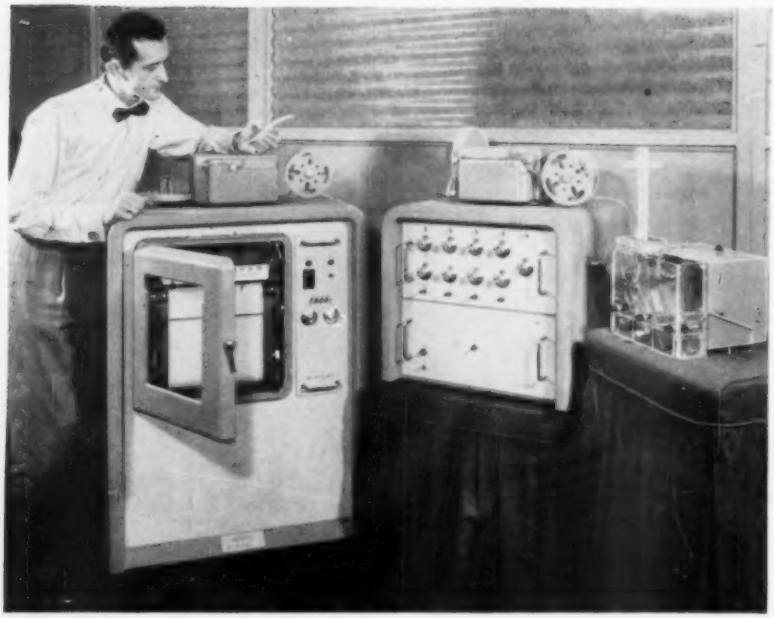
This was the 1956 Aircraft Spark Plug and Ignition Conference, sponsored by the Champion Spark Plug Company to provide a forum for the interchange of information on all phases of aircraft ignition—for the benefit of everyone in aviation.

The sessions were recorded word for word, and a complete transcript of every question and answer will soon reach Champion representatives and distributors. If you have an ignition problem, chances are they have the solution.

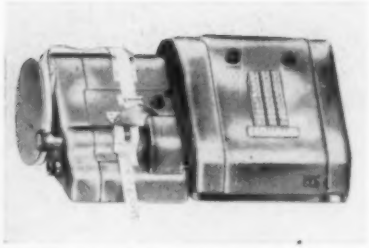
Why not ask them?

World's favorite
CHAMPION
SPARK PLUGS

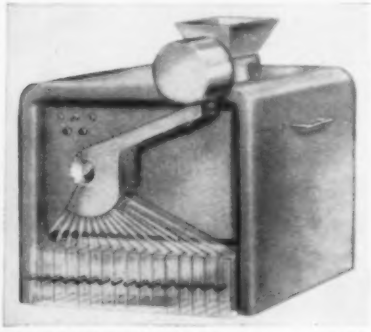
CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO



ASTRAMATIC, new system automatically tests avionic components, sorts them according to value, records its findings, then plots them up in bar-graph (histogram) form.



KEYBOARD tabulator for use with manual testing will record data on tape for plotting.



COMPONENTS dumped into hopper of this device are tested and automatically sorted.

New Test System May Aid Avionics Firms Meet New Reliability Criteria

By Philip J. Klass

New York—Astramatic, a new automatic system for production-line testing, sorting, data recording and quality control analysis of avionic components, can speed such operations by a factor of 10 to 20.

The new system could aid avionic equipment manufacturers in meeting the new stiff reliability criteria which the Defense Department plans to include in future avionic production contracts (AW Mar. 12, p. 249).

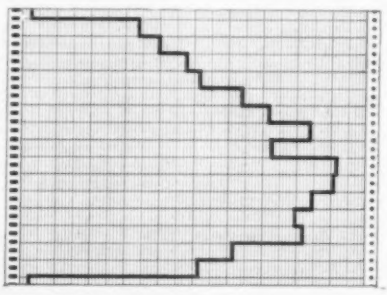
Astramatic, described here during the recent International Automation Exposition, was developed by Electronic Control Systems, Inc., an affiliate of Stromberg-Carlson, which is a subsidiary of General Dynamics Corp.

The present system can test axial-lead type components (resistors, diodes) at a rate of more than 3,600 per hour, automatically sort them into as many as 16 different categories depending upon their measured values, ECS says. Test results simultaneously are recorded on punched tape, then analyzed and plotted as a 16-interval bar-graph (histogram) which resembles a distribution curve of the batch of components under test.

ECS is now developing an auxiliary computer which will automatically calculate the average and standard deviation and graphically present such information, ECS Engineer Eugene Hoo reported.

Although the Astramatic system principles can be applied to the processing of a variety of different components, including non-avionic, the present system consists of the following:

• **Component Handler-Sorter.** Unit has hopper feed that permits bulk loading of axial-lead components to minimize loading time. Device is easily adjusted to accommodate components with different body lengths and diameters. Components are transported internally into test position, tested, then deposited into one of 16 bins according to their measured values.



HISTOGRAM shows number of components with different values in batch tested.

• **Tester-Recorder.** This device controls the component test conditions, measures resultant voltage on a d.c. digital voltmeter. Operator-selected range of values is divided into 16 equal sub-ranges, corresponding to 16 bins in Component Handler-Sorter. The Tester-Recorder punches tape after each component is tested to record into which of 16 sub-ranges the particular component value falls. A relay matrix also operates automatically to cause the Component Handler-Sorter to deposit the component in the appropriate bin.

• **Analyzer-Recorder.** The punched tape record, when fed into this device, causes it to tabulate each of the components in one of 16 registers, each corresponding to a different component value. When the entire tape has been read, or at any intermediate point, the operator can cause the recorder to plot out a bar-graph (histogram) of the batch by pushing a button. The histogram shows how many components within the batch fell into each of the 16 different value sub-ranges.

With conventional manual test procedures, where the operator must make the decisions, record the data, and perform the necessary sorting, the process takes an average of 20 seconds per component, Hoo says. Astramatic does the job in one second.

To prepare test data for 600 components into a form for plotting a histogram, and making the actual plot, may

Now–Chemical Milling of Aluminum & Magnesium!

The exciting new weight-saving process in aircraft manufacture... *chemical milling* ...has now been successfully applied to *magnesium* parts at USCM. Widely accepted by major airframe producers as an ideal method of milling *aluminum* parts, the new process has now been proved equally effective with magnesium.

This development opens up still broader horizons for aircraft and missile designers. It means that the weight of aircraft can be reduced up to *hundreds of pounds*, without sacrifice of strength, through chemical milling.

At USCM, both aluminum and magnesium parts are now being chemically milled with precision and economy, on a round-the-clock schedule. *For complete information, write for* TECHNICAL BROCHURE, *or contact our engineering department for consultation.*

WHAT IS CHEMICAL MILLING?

It is the controlled removal of metal by chemistry, by masking the part to be treated, then immersing it in an etching bath for a precision-timed period.

WHERE *is chemical milling most widely used?...* To remove unneeded weight in the production of aircraft and missile parts.

WHEN *was chemical milling introduced?...* It has been used on thousands of aircraft parts during the last three years.

WHY *is chemical milling an advantage?...* Chemical milling handles parts with contours and shapes that are impossible with machine milling methods, to extremely close tolerances, and offers many other unique benefits.

WHO *is the leader in chemical milling?...* The United States Chemical Milling Corporation handles a greater volume of chemical milling production than any other company in the nation. Its new facilities at Manhattan Beach now enable USCM to produce an increased volume of chemical milling work on a subcontract basis.

UNITED STATES CHEMICAL MILLING CORPORATION

1700 Rosecrans Avenue, Manhattan Beach 4, California

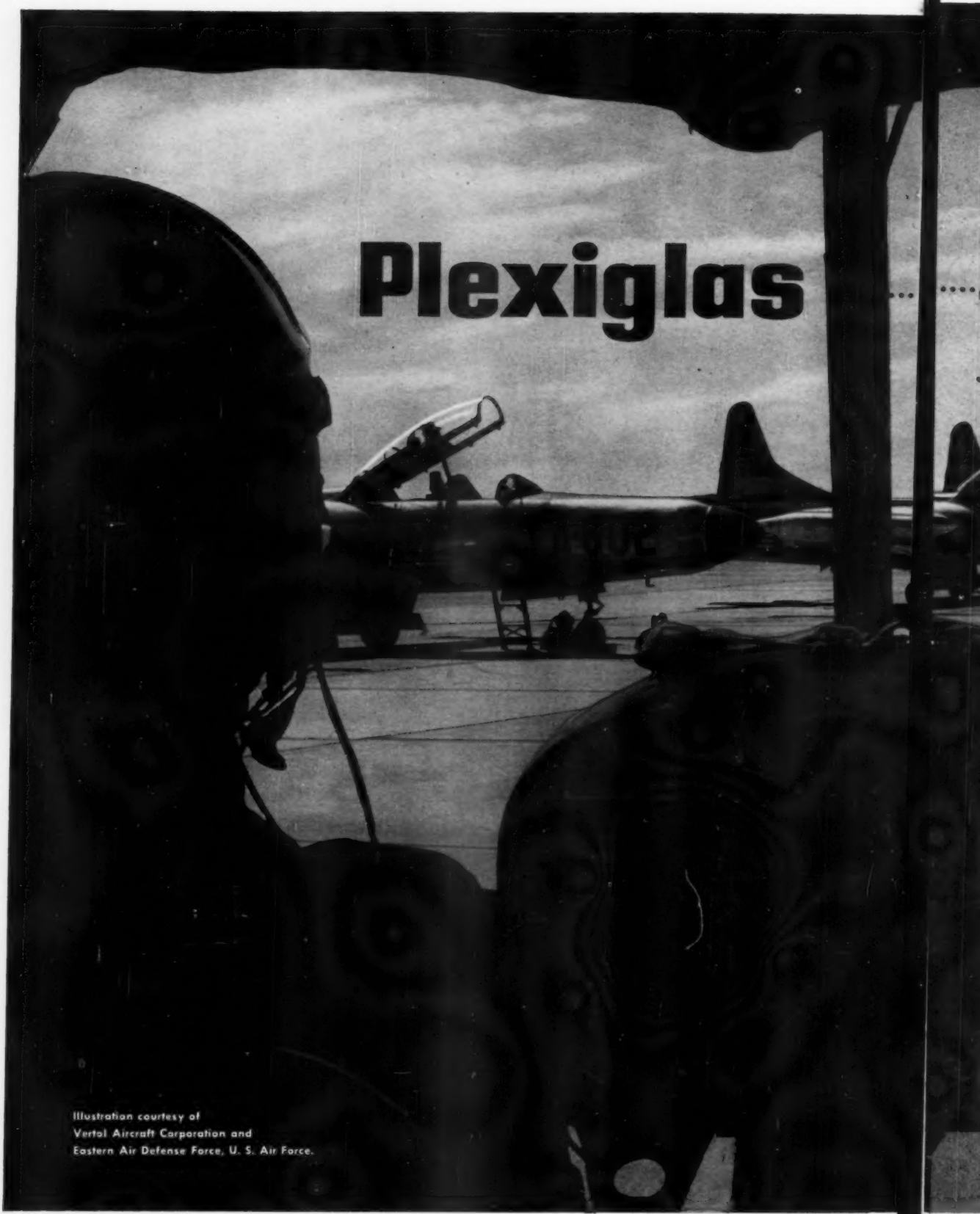
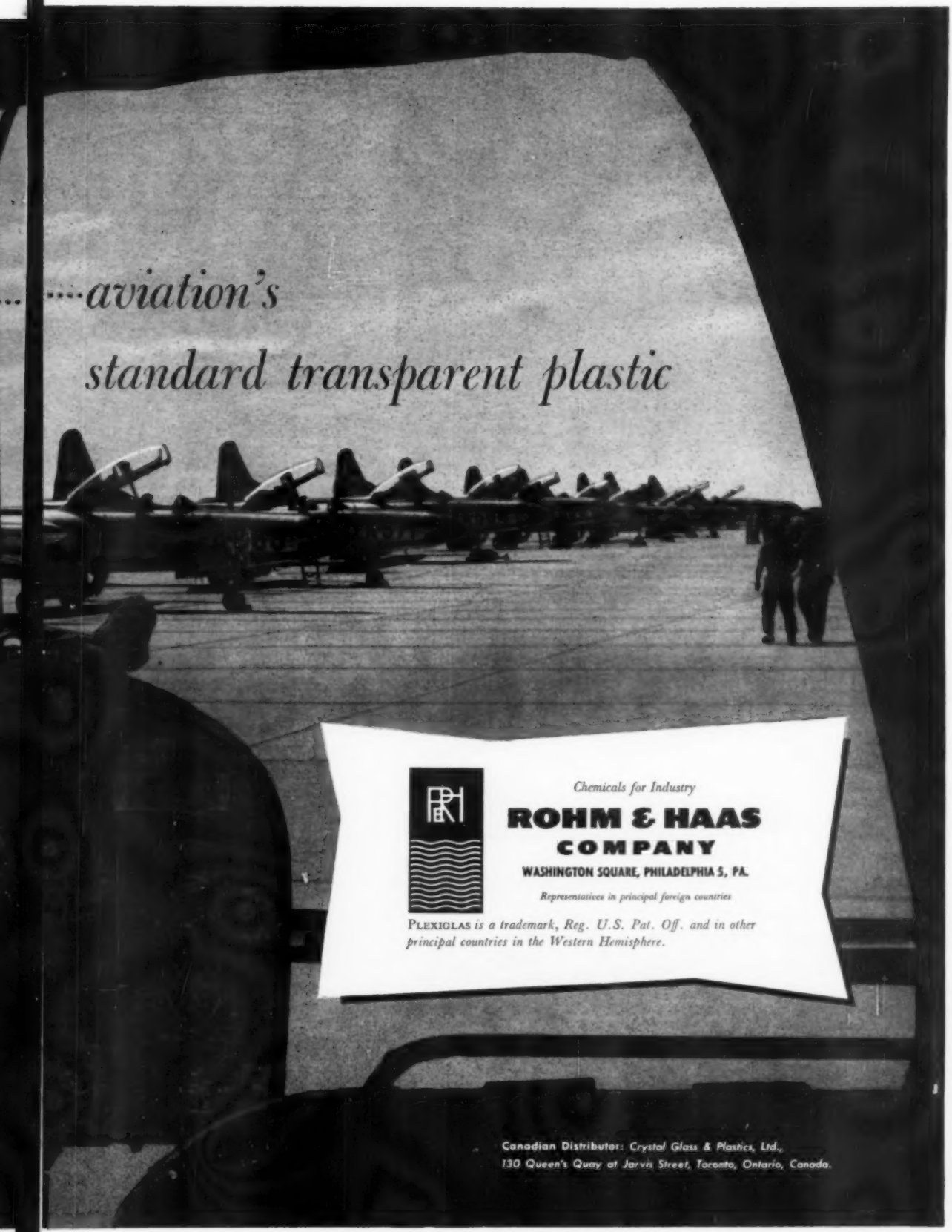


Illustration courtesy of
Vertol Aircraft Corporation and
Eastern Air Defense Force, U. S. Air Force.



Chemicals for Industry

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Representatives in principal foreign countries

PLEXIGLAS *is a trademark, Reg. U.S. Pat. Off. and in other principal countries in the Western Hemisphere.*

Canadian Distributors: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada.*

First there's the 120 Wirewound TRIMPOT, with features common to all other BOURNS TRIMPOTS. It's a 25-turn potentiometer, easily adjusted, and weighing only 0.1 oz. Rectangular in shape, it fits readily into miniature electronic circuits. You can mount it individually, or stack it compactly with standard screws. Mountings are interchangeable with those on all other TRIMPOTS.

The self-locking shaft holds stable settings under extreme environmental conditions. All parts are corrosion resistant. Every unit is inspected 100% for guaranteed specifications. Resistances: 10 to 20,000 ohms, with resolutions as low as 0.2%.

Now, to give designers greater latitude, BOURNS has developed and is manufacturing the following standard models—variations of the Model 120.

120 TRIMPOT
—Carbon
Infinite resolution is provided by the carbon element. Resistances are higher, ranging from 20,000 ohms to 1 megohm.

130 TRIMPOT
—Solder Lug
For wiring direct to the instrument, using soldering iron or dip soldering techniques. Usable range of 98%.

132 TRIMR
—Variable Resistor
High resistances—up to 50,000 ohms in a wirewound rheostat.

209 TWINPOT
—Dual Potentiometer
Two outputs electrically independent, and controlled simultaneously by one adjustment.

160 TRIMPOT
—High Temperature
Operates at 175°C. High power rating: 0.6 watt at 50°C.

230 TRIMPOT
—Humidity-proof
Completely sealed, unit meets MIL-E-5272A Specifications for humidity.

Write for literature on the BOURNS TRIMPOT line.

BOURNS LABORATORIES
General Offices: 6135 Magnolia Ave., Riverside, Calif.
Plants: Riverside, California—Ames, Iowa

take more than an hour, Hoo says whereas Astramatic can do the task in less than three minutes.

To provide some of these advantages to manufacturers who do not wish to invest in fully automatic test equipment, ECS has come up with a Keyboard Classifier. This device, resembling a desk calculator, enables a test station operator to record individual component test readings on a keyboard, which automatically punches a permanent tape record. This tape can then be fed into the Analyzer-Recorder for automatic classification and plotting of a histogram.

Electronic Control System, Inc. is located at 2136 Westwood Blvd., Los Angeles 25, Calif.

NAA Develops TV Gunnery Instruction

A gunnery instruction monitor has been developed by North American Aviation's Columbus Division to enable instructors to give corrective advice to students immediately when errors are made during gunnery passes.

Known as NAGIM, the system used a closed-loop transistorized television circuit. Student pilot's target and gunsight reticle are viewed by a small TV camera and seen by instructor on a 3-in. scope mounted on the instrument panel shroud. Without the system, the student's effort had to be assessed after viewing gun camera film.

The new system weighs less than 50 lb., can be installed with little effort.

Los Alamos in Line For Speed Computor

A new super-speed digital computer, capable of operating 100 to 200 times faster than any comparable general purpose computer available today, will be developed by International Business Machines Corp. for installation at the Los Alamos Scientific Laboratory.

The new computer, to be called STRETCH, will consist of a group of inter-connected machines, each performing specialized functions. One such device, called a "bookkeeping computer" will convert data into a useable code before it is introduced into the central computer. This will permit the machine's main arithmetic unit to operate almost continuously, in contrast to present computers.

The machine will be able to accept information from several input sources simultaneously and act upon it in parallel, IBM says. Incoming and outgoing data will pass through an electronic multiplex unit which will route it to the correct locations.

STRETCH will be able to multiply

Semiconductor Business

Semiconductor industry business will increase 500% in next four years, from present $60 million annual figure, according to Hughes Aircraft Co. estimates. The figure includes diodes, rectifiers and transistors. Hughes reveals that it now produces about 20% of the industry's total semiconductor output with current sales of about $12 million. Company also discloses its 1956 sales of semiconductors, missiles, fire control and other avionic systems will exceed $300 million, almost 50% above its 1953 sales. Backlog is over $500 million, HAC says.

two 12 to 15 digit numbers at the rate of 500,000 per second and add two such numbers at a rate of two million per second. A complex nuclear problem, involving up to 100 billion arithmetical operations that might keep an IBM 701 or 704 busy for six months, can be solved by the new machine in about one day, the company says.

An interesting sidelight is the fact that IBM plans to use its 704 computer to analyze the potential performance and circuits for its new STRETCH machine.

Expansions, Changes In Avionics Industry

Sylvania Electric Products, Inc. will build a multi-million dollar research and development center in Amherst, N. Y., for its Electronic Systems Division to house activities now located at the firm's nearby Buffalo plant.

Construction of the new 100,000-sq.-ft. facility will begin early next year on an 18-acre site near the Buffalo Municipal Airport.

Sylvania expects to employ approximately 500 at the new laboratory when it goes into operation next year. Company also will build new 50,000 sq. ft. addition to its Electronics Division headquarters plant at Woburn, Mass., scheduled for completion next July.

Other recently announced expansions and changes in the avionics industry include:

• **General Electric** has formed new Communication Products Dept. in its Industrial Electronics Division to handle GE mobile radio, microwave radio relay, and other communication systems. New department will be headed by Harrison Van Aken, Jr.

• **Stavid Engineering, Inc.,** Plainfield, N. J., is constructing a new 65,000-sq.-ft. facility, the second phase in the firm's planned expansion program.

• **Universal Match Corp.,** St. Louis, Mo., has acquired Dynamics Research Associates, Seattle, engaged in the de-

MALLORY·SHARON reports on

TITANIUM

Chance-Vought Crusader on flight deck of the U.S.S. Forrestal. The Navy recently set a new U.S. speed record of 1015 m.p.h. with the Crusader in winning the Thompson Trophy event.

Crusader's dark tail— sign of a bright future

Inspection of tail cone assembly. By its emphasis on consistent titanium quality, Mallory-Sharon simplifies work required in fabrication.

• Notice how the fuselage gets darker as your eyes look fore to aft?

The dark area identifies the use of titanium for the tail cone that covers the jet engine. Titanium is the *only* light metal that can stand the intense heat. Thus titanium alloy is used for the entire tail cone, including outer skin and inner bulkheads and support members. The use of hundreds of pounds of titanium alloy here saves precious weight, helps put the Crusader in the over-1000-mile-per-hour class.

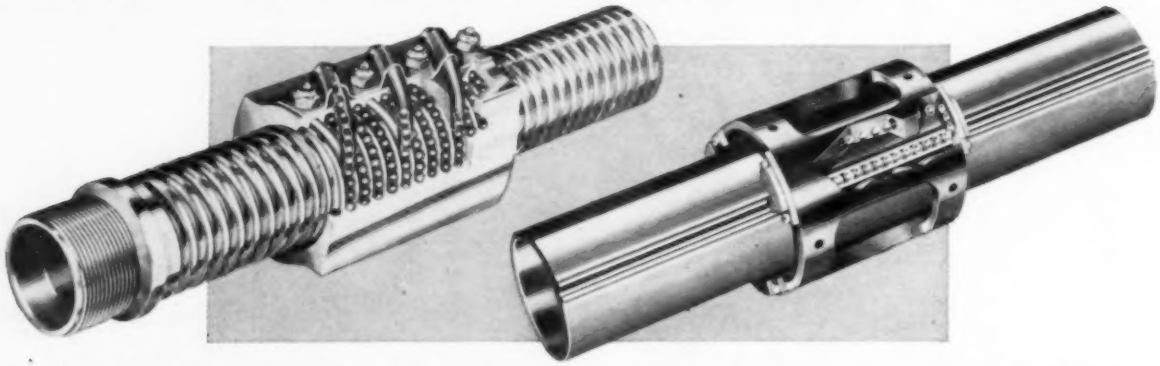
With each new or improved aircraft design more titanium from Mallory-Sharon is used . . . this remarkable metal is a dependable, uniform material. For example, Mallory-Sharon certifies the uniformity of titanium mechanical properties, and guarantees optimum machineability. For quality you can depend upon, call Mallory-Sharon for your requirements in titanium.

MALLORY-SHARON TITANIUM CORPORATION, NILES, OHIO

MALLORY Ti SHARON

These MODERN Recirculating Ball Units can help you...

SOLVE ACTUATION and TORQUE PROBLEMS



Saginaw b/b Screws guaranteed 90% efficient —offer 6 major advantages for designers

Available in custom machined and commercial rolled thread types—have been built from 1½ inches to 39½ feet long—⅜ to 10 inches diameter.

Nut *glides* on steel balls. Like stripes on a barber pole, the balls travel toward end of nut through spiral "tunnel" formed by concave threads in both screw and mating nut.

At end of trip, one or more tubular guides lead balls diagonally back across outside of nut to starting point, forming closed circuit through which balls recirculate.

1 VITAL POWER SAVINGS. With guaranteed efficiency of 90%, Saginaw b/b Screws are up to 5 times as efficient as Acme screws, require only ⅓ as much torque. This permits much smaller motors with far less drain on the electrical system. Circuitry is greatly simplified.

2 SPACE/WEIGHT REDUCTION. Saginaw b/b Screws permit use of smaller motors and gear boxes; eliminate pumps, accumulators and piping required by hydraulics. In addition, Saginaw b/b Screws themselves are smaller and lighter. Units have been engineered from 1½ in. to 39½ ft. in length.

3 PRECISE POSITIONING. Machine-ground Saginaw b/b Screws offer a great advantage over hydraulics or pneumatics because a component can be positioned at a predetermined point with precision. Tolerances on position are held within .0006 in./ft. of travel.

4 TEMPERATURE TOLERANCE. Normal operating range is from −75° to +275° F., but assemblies have been designed in selected materials which function efficiently as high as +900° F. These units are practical where hydraulic fluids have lost efficiency or reached their flash point.

5 LUBRICATION LATITUDE. Even if lubrication fails or cannot originally be provided because of extreme temperatures or other problems, Saginaw b/b Screws will still operate with remarkable efficiency. Saginaw units have been designed, built and qualified for operation without any lubrication.

6 FAIL-SAFE PERFORMANCE. Far less vulnerable than hydraulics. In addition, Saginaw offers three significant advantages over other makes: (1) Gothic arch grooves eliminate dirt sensitivity, increase ball life; (2) yoke deflectors and (3) multiple circuits provide added assurance against operating failure.

Saginaw b/b Splines average 40 times lower friction coefficient than sliding splines

Transmit or restrain high torque loads far more efficiently—have been built from 3 inches to 10 feet long—⅜ inch to 6 inches in diameter.

The *Saginaw b/b Spline* radically increases the efficiency of transmitting or restraining high torque loads. Instead of *sliding* against each other, surfaces *glide* on rolling balls.

The steel balls recirculate in closed circuits formed by mating longitudinal raceways spaced around the circumference of inner and outer splines. Guides return balls.

This revolutionary new kind of spline utilizes the same basic principle pioneered by Saginaw in the ball/bearing screw.

It permits new engineering designs never before practical—literally lets you achieve the "impossible"! In any application where column length must change under torque load, the Saginaw b/b Spline offers greatly decreased friction, less wear, longer life, more dependable operation. It can be fitted with integral gears, clutch dogs, bearing and sprocket seats or a wide choice of other attachments for use with electric, hydraulic or pneumatic units. To convert push-pull to rotary motion, helical types are available with very high leads, ranging from 20:1 to 100:1.

SEND TODAY FOR THIS FREE 1957 ENGINEERING DATA BOOK...

Saginaw ball bearing Screws and Splines

SAGINAW STEERING GEAR DIVISION OF GENERAL MOTORS

WORLD'S LARGEST PRODUCER OF BALL BEARING SCREWS AND SPLINES

Saginaw Steering Gear Division
General Motors Corporation
b/b Screw and Spline Operation
Dept. 4B, Saginaw, Michigan

Please send new engineering data book on Saginaw b/b Screws and Splines to:

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COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

velopment and production of magnetic amplifiers, automatic controls and airborne instrumentation. The new UMC division will be headed by Alfred C. Block as general manager and Robert G. Bryson, assistant general manager, both of whom have been with DRA since it was founded.

• **Federal Telecommunications Laboratories** have opened a branch Communications Laboratory in Palo Alto, Calif., headed by W. S. Chaskin, former manager of carrier development at Lenkurt Electric Co. Address: 809 San Antonio Road.

• **Milro Controls Co.**, Park Ridge, N. J., is name of new company formed by Milton Rosen, former chief engineer of Bart-Messing Corporation's Rectifier Equipment Division. New company will develop and produce magnetic amplifier and transistor devices. Company address: Hawthorne Ave.

• **Little Falls Alloys, Inc.**, Paterson, N. J. has added facilities for the flattening and tinning of alloy wire. Flat wire is available in beryllium copper, phosphor bronze, brass and other alloys. Company address: 189 Caldwell Ave., Paterson, N. J.

• **International Business Machines Corp.** and **University of California** at Los Angeles have established a Western Data Processing Center on the UCLA campus as a result of a multimillion dollar gift by IBM which includes the use of an IBM 705 computer. New facility will be available to West Coast industry and also will be used to train students in the use of electronic data processing systems.

• **Sylvania Electric Products, Inc.** and **Corning Glass Works** plan to form jointly owned company to expand their research, development and production activities in the atomic energy field. The new organization, to be called Sylvania-Corning Nuclear Corp., will take over the atomic energy activities of the two companies.

• **Ace Electronics Associates, Inc.**, Somerville, Mass., maker of precision wire-wound potentiometers, has increased its floor space by 25%, the second such expansion within a year.

The following have announced appointment of new representatives:

• **International Electronic Research Corp.**, Burbank, Calif., products will be sold by The Don Smith Sales Co. in Alaska, Washington, Oregon, British Columbia, Northern Idaho and Western Montana. Sales in the states of Colorado, Utah and Wyoming will be handled by The Fred A. Pease Co.

• **Avien, Inc.**, has appointed Brian Engineering, Ltd., Montreal, as its sales and engineering representative in Canada.

• **The Narda Corp.**, Mineola, N. Y., has appointed The M. P. Odell Co.

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...an established concept at Convair-Pomona where your opportunities in the career of your choice are virtually unlimited. Work in the finest engineering facility in the country at America's first exclusive Guided Missile plant. Ultra-modern surroundings, completely air-conditioned, in beautiful Pomona only minutes from Los Angeles, the mountains, the seashore or desert recreation. Here is country living near the city at its best:

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Generous travel allowance to Engineers who are accepted. Write now enclosing a complete resume to:
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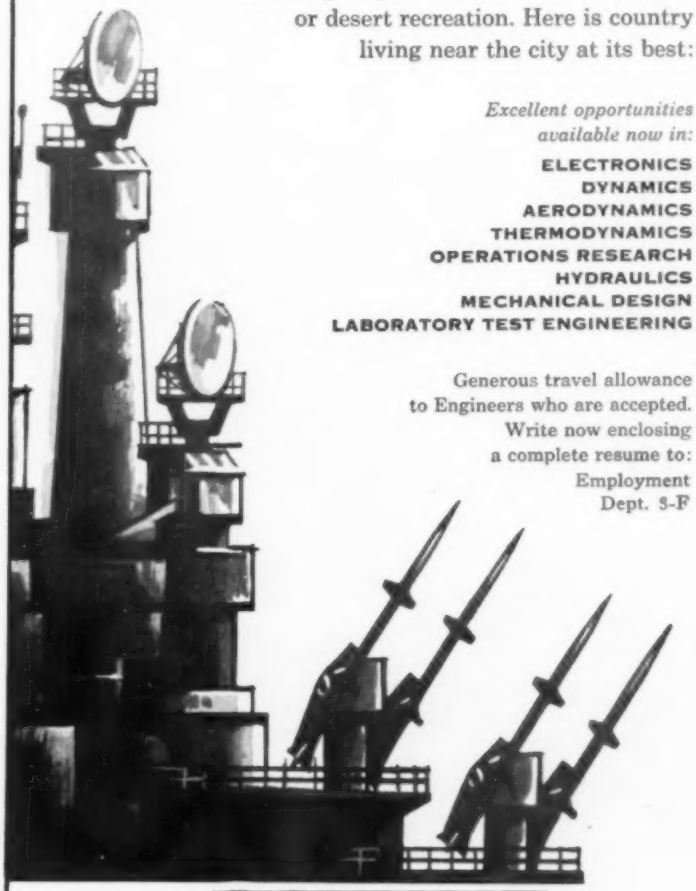

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A DIVISION OF
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PRATT & WHITNEY AIRCRAFT ENGINES

ESSO AVIATION OIL

Setting performance standards throughout the world

Combined research and development did it! More than twenty years ago, these two great companies joined in research and development to produce Esso Aviation Oil. The standard of quality *then*, this oil is *still* setting performance standards in engine lubrication, not only for Pratt & Whitney Aircraft, but for many of the world's major airlines.

This teamwork is still in effect, producing the new lubricants which set performance standards in the jet engines of tomorrow's transports.

ESSO STANDARD OIL COMPANY

Westlake, Ohio, as its exclusive representative in Ohio, Michigan, Western Pennsylvania, and parts of West Virginia. The new representative has field offices in Dayton, Cleveland, Pittsburgh, and Detroit.

• **The Marion Instrument Co.,** Manchester, N. H., will market its products in Southern Indiana, Southern Ohio and Kentucky through The Beedle Equipment Co., Cincinnati.

FILTER CENTER

▶ **Midget Molded Magnetic Memory**—New type of magnetic computer storage element consisting of molded ferromagnetic cores on thin printed circuit plates will make it possible to store more than a million bits of data in a device the size of a shoebox, according to Radio Corporation of America which developed the technique. The new RCA storage element functionally resembles the familiar magnetic core matrix, but it is far less costly to make because it eliminates the difficult problem of threading input-output windings through tiny magnetic cores. Read-out time is quoted at "a few millionths of a second." RCA has constructed a 2,560 bit memory occupying only two cubic inches.

▶ **Lear Shows LABS Tie-In**—USAF's Low Altitude Bombing System (LABS) which enable fighter-bomber pilot to toss bomb during pull-up phase of an Immelman maneuver has been tied in with a Lear L-10 autopilot which automatically puts airplane into pre-selected maneuver when pilot pushes a button. The autopilot-LABS combination eases pilot training and provides more precise bombing, Lear says. The L-10/LABS system was evaluated in an F-84F and demonstrated during recent USAF Fighter Weapons Meet at Nellis AF Base.

▶ **TWA Buys Collins PWI**—Trans World Airlines has placed orders for fleetwide installation of Collins Radio's proximity warning indicator (PWI), bringing the total on order to approximately 900.

▶ **ATC Transponder Flexibility**—The Air Traffic Control Transponder which Packard-Bell is designing and will produce for Radio Corporation of America will have provision for generating 64 reply codes (instead of the 11 now authorized), and modification to provide two additional interrogation modes "would not be a difficult job," a company spokesman says. The transponder also has the capability of spacing its reply codes at 1.45 microsecond intervals instead of the presently authorized

VIBRATION CONTROLLED...

And where *high* engine torque is applied to *big*, broad-bladed propellers . . . the combination is one to put any vibration isolator to the test, both on performance and durability.

MB Type 5100 Mounts were designed for just such a punishing job. Four of them mount each powerful T-34 turboprop engine on the YC-97J and YC-121F, properly isolating airframe from engine. With up to 1000 trouble-free service hours already accumulated in controlling vibration, long service life is assured.

Vibration is MB's major business. Whether you're interested in help on vibration *control* or *testing*, there are over 17 years of successful experience ready to serve you.

manufacturing company
A Division of Textron Inc.
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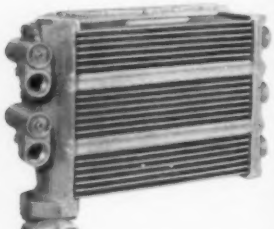
New Haven 11, Conn.

HEADQUARTERS FOR PRODUCTS TO ISOLATE VIBRATION
. . . TO EXCITE IT . . TO MEASURE IT

Oil's cool on the Vertol H-21 Transport Helicopter with HARRISON on the job!

Fahrenheit's right every flight . . . with Harrison on board! Harrison oil coolers keep vital temperatures in check on transmissions and engines . . . allowing 'copters to fly faster, farther and carry heavier payloads than ever before. These oil coolers are compact, save weight and space. They're specially designed to do the job and do it better. You'll find Harrison handling the heat in every line of industry and defense . . . from hydraulic presses to supersonic jets. That's because every Harrison product is backed by over 46 years' experience in producing top-quality heat-control equipment. If you have a cooling problem, look to Harrison for the answer.



Harrison oil coolers level heat for all kinds of aircraft—from small private planes to intercontinental bombers.

GM GENERAL MOTORS

Watch "WIDE, WIDE WORLD" Sundays on NBC-TV

TEMPERATURES MADE TO ORDER

HARRISON

RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N.Y.

2.90 microsecond intervals, which would increase the available codes from 64 to 8,192. (AW Nov. 19, p. 77.)

▶ **Transistor Conference**—The 1957 Transistor and Solid-State Circuits Conference will be held at the University of Pennsylvania, Philadelphia, Feb. 14-15 Conference is sponsored by IRE, AIEE, and University of Pennsylvania. Advance registration forms can be obtained by writing F. W. Anderson, General Electric Co., 3198 Chestnut St., Philadelphia 4, Pa.

▶ **New Business**—Recent announcements of new contracts by avionics contractors include:

• **Ultrasonic Corp.,** Cambridge, Mass., has received multi-million dollar contract to manufacture "one of the complex sub-systems for the new B-58 (Hustler) Bomber."

• **Craig Systems, Inc.,** Danvers, Mass., has received a $2.2 million contract for air traffic control equipment and communications facilities from the Air Materiel Command.

• **General Precision Laboratory, Inc.,** Pleasantville, N. Y., reports three new sub-contracts, totaling over $1.5 million from the Glenn L. Martin Co., Baltimore. These are in adition to previous $5 million Martin award for system development and manufacture.

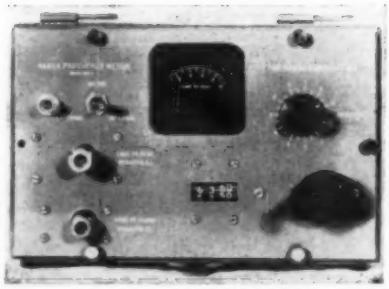
• **Cook Company,** Denver, reports $33,000 contract from the National Bureau of Standards facility at Boulder, Colo., for 60 VHF radio receivers to be used in NBS scatter propagation research. Some of the receivers, designed by NBS, will be set up in South America.

• **Servo Corp. of America,** New Hyde Park, N. Y., reports a $143,000 contract from Army Signal Supply Agency, Laboratory Procurement Office, for development of high accuracy direction finding set, designated AN/TRD-15, for use in air-sea rescue program and as a navigation aid. Set is intended to permit direction finding on very short duration transmissions.

NEW AVIONIC PRODUCTS

Microwave Components

• **Klystron power supply,** Model PC-33, provides continuously variable output from zero to 30 kv. at currents up to 2 amps d.c. with ripple of less than 0.04%. Similar unit, Model PC-44, provides voltages up to 3 kv. at currents up to 6 amp. for bombarded-cathode applications. Both units operate from 230 v., 3-phase, 60 cps. Levinthal Electronic Products, Inc., Redwood City, Calif.



• **Frequency meter,** Model 802B, covers range from 2,350 to 10,500 mc., an extension over its predecessor, and includes a digital counter system for direct reading of frequency. Accuracy is rated at 0.2%. The Narda Corp., Mineola, N. Y.

• **Microwave dielectric tester,** permits direct readings of permittivity and loss tangent for small samples at fixed spot frequencies. Three different models cover frequency range of 6 to 17 kmc. Dielectric measurements can be made at temperatures up to 450C. Microcell Electronics, 56 Ridgeway, London W.C. 2, England.

• **Tripolar video detector crystal,** Type IN630, operates at temperatures up to 150C over frequency range of 1 to 12.4

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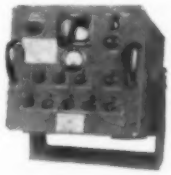

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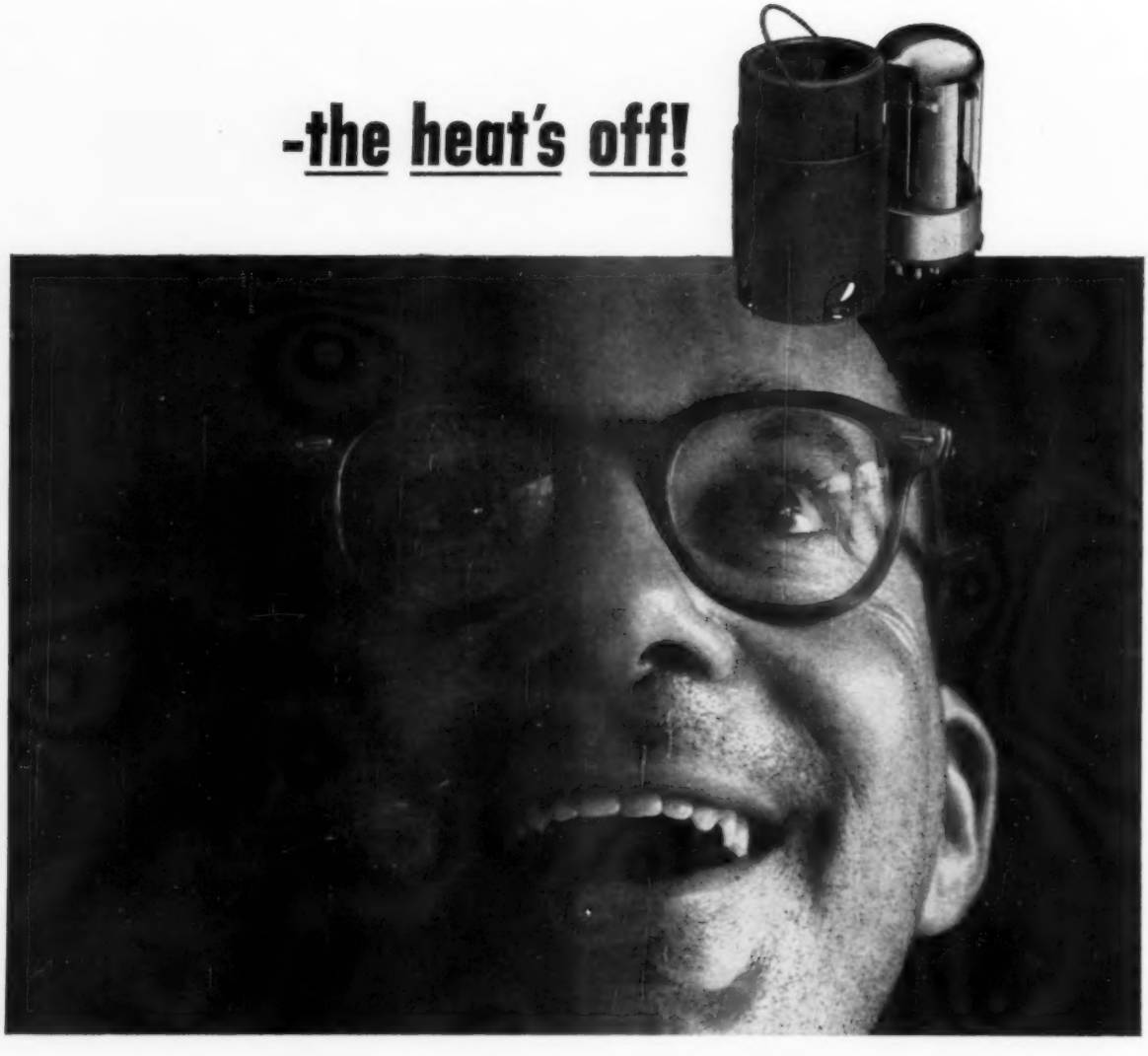

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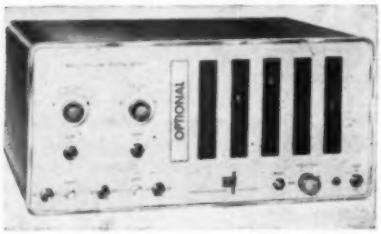
kmc., providing tangential sensitivity of minus 40 dbm. over this entire range of frequencies and temperatures. The tripolar design provides a second signal terminal on the coaxial crystal. Sylvania Electric Products Inc., Electronics Div., Woburn, Mass.

• **K_u band variable power divider,** operates over frequency range of 16 to 17 kmc., has maximum insertion loss of less than ½ db. and maximum input mismatch of 1.2. Relative phase of two equal input signals determines whether energy from two output arms is equal or

whether entire output is available only at one or the other of the output arms. Phase shift of incoming signals is accomplished by short slot hybrid junction with adjacent arms, terminated in moveable short circuits. Further details are available from manufacturer. Write Airtron, Inc., Dept. B, 1103 West Elizabeth Ave., Linden, N. J.

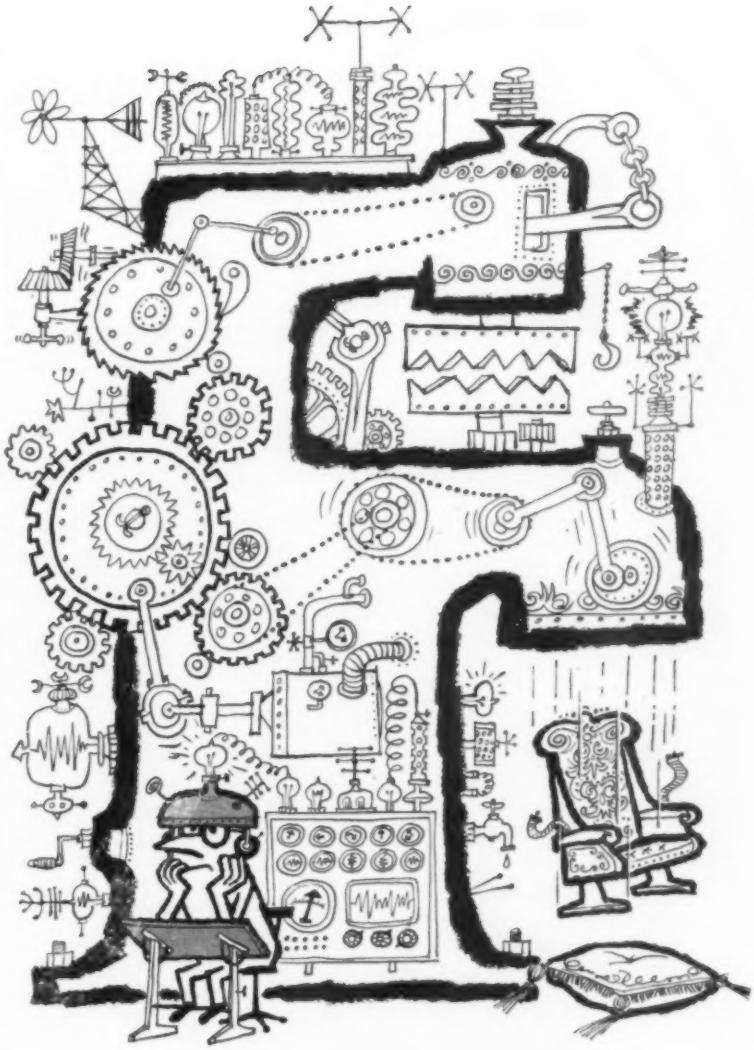
Test Equipment

• **Digital time interval meter,** Model 250A, for measuring elapsed time between two events occuring the range of 10 microseconds to 1 second. Optional feature includes extension to 10 or 100,000 seconds. Accuracy is 10 micro-



seconds. Short term stability is quoted at one part in a million; long term stability at five parts in one million per week. Device is priced at $495. Computer Measurements Corp., 5528 Vineland Ave., North Hollywood, Calif.

• **Servo motor dynamometer,** Model HDE-100, will measure stall, starting or running torque of small servo motors and can be provided with maximum torque scales of 0.5 to 6 oz.-in. Device



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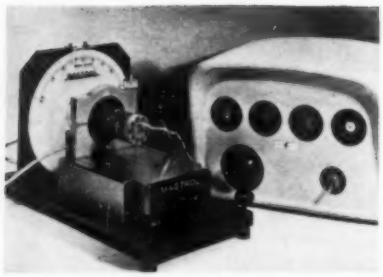
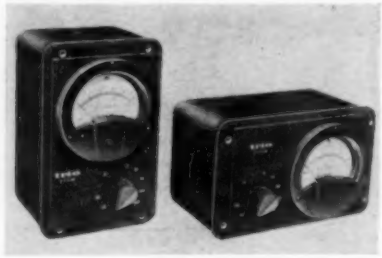


employs hysteresis brake to absorb motor power and calibrated pendulum to measure motor running torque. Maximum error is quoted at 1%. A photoelectric cell type of non-loading tach generator gives motor speed with accuracies of 0.5% or better. Device can accommodate servo motors with output shaft diameters of 0.06 to 0.25 in. Magtrol, Inc., Instrument Div., 38 Virginia Place, Buffalo, N. Y.

• **Miniature ac. vacuum tube voltmeter,** Model SD152, designed for panel mounting in avionic equipment, reportedly meets MIL specs. Units measure 4¼ x 4¼ x 6¾ in., operate from 115 v., 60 or 400 cps., have frequency response of 20 to 50,000 cps and input imped-



ance of 1 megohm. Standard accuracy is 3% of full scale, but 2% is available if desired. Trio Laboratories, Inc., 4025 Merrick Rd., Seaford, N. Y.

Components & Devices

• **Electro-mechanical filters,** weighing only 7 oz. and measuring 1½ x 1¼ x 3¾ in. suitable for single sideband receiver use, come in Types MFU-250-1 for 250 kc. upper sideband use or MFL-250-1 for lower sideband use. Operating temperature range is —40 to 85C. Radio Corp. of America, Electronic Products Div., Camden, N. J.

• **Miniature voltage stabilizer tube,** Type 75C1, employs special uranium oxide coating which ensures maximum striking voltage is 110 volts in daylight or darkness. The 75-volt stabilizer tube has regulation of only 9 v. over current range of 2 to 60 ma. and the burning voltage varies less than 1% per 1,000 hours, according to manufacturer, Mullard Overseas Ltd. U.S. representative is: International Electronics Corp., 81 Spring St., New York 12, N. Y.

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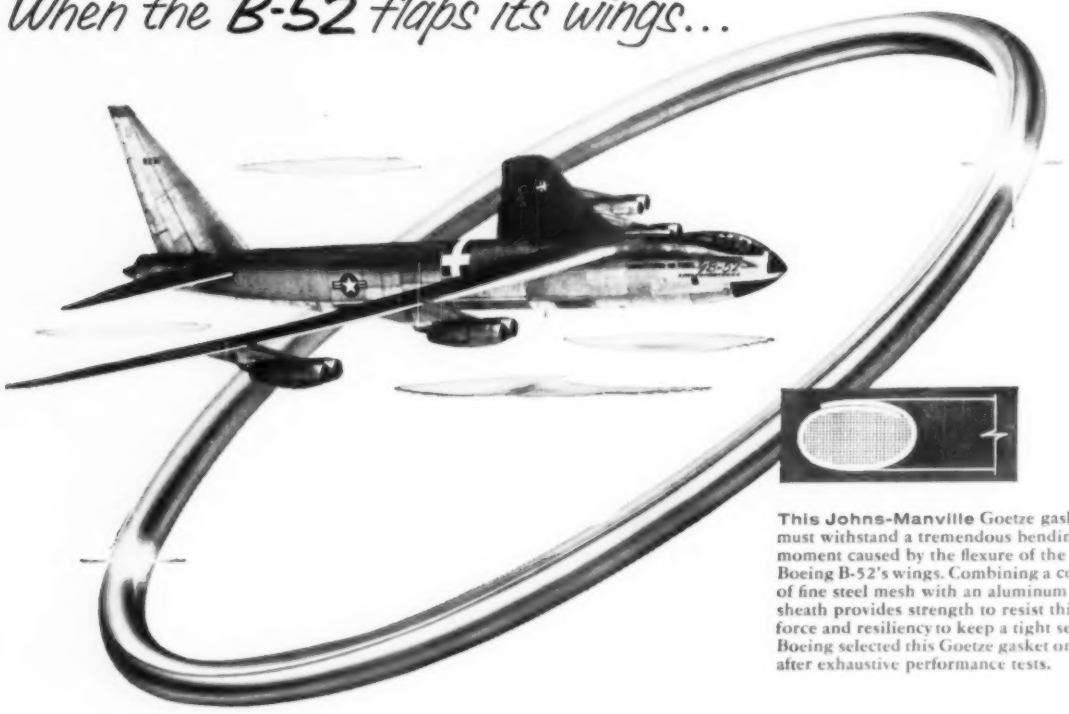
HYATT HY-ROLL BEARINGS FOR AIRCRAFT INDUSTRY

When the B-52 flaps its wings...



This Johns-Manville Goetze gasket must withstand a tremendous bending moment caused by the flexure of the Boeing B-52's wings. Combining a core of fine steel mesh with an aluminum sheath provides strength to resist this force and resiliency to keep a tight seal. Boeing selected this Goetze gasket only after exhaustive performance tests.

Johns-Manville Goetze Gaskets

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THIS critical sealing problem was solved for Boeing with a special gasket, designed and engineered by J-M Goetze Gasket technicians.

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Johns-Manville PRODUCTS FOR THE AVIATION INDUSTRY

Avco to Build New Research Center

Lawrence, Mass.—Avco Manufacturing Corp. will build a $15 million research and development center devoted to basic and applied science at Wilmington, Mass. Dr. Lloyd P. Smith, president of Avco Research and Advanced Development Division, said the new center (above) will be in operation by mid-1958.

Research and development division of Avco, organized 14 months ago, presently is operating in Lawrence and at the Avco Research Laboratory in Everett, Mass. It is concerned largely with advanced missile systems for the Department of Defense. All of the research and development facilities will be moved to the new center at Wilmington.

The new center, covering 16 acres, will consist of four buildings and provide over 400,000 sq. ft. of floor area. Avco expects to employ about 1,500 persons in the new plant.

Certificates of Necessity

Washington—Office of Defense Mobilization has awarded Avco Manufacturing Corp.'s Research and Advanced Development Division a certificate of necessity for accelerated tax amortization in the amount of $9,975,950 for research and development facilities. Of the amount certified, 75% is allowed at the rapid rate. Other certificates awarded:

McDonnell Aircraft Corp., St. Louis, Mo., military aircraft and bomb shelter, $394,000 certified with 100 pc allowed and $1,402,000 certified with 60 pc allowed.

Lockheed Aircraft Corp., Missile Systems Division, Van Nuys, Calif., research and development, $897,617 certified with 65 pc allowed.

Boeing Airplane Co., Seattle, Wash., military aircraft, $3,413,910 certified with 65 pc allowed.

The Trane Co., LaCrosse, Mich., military aircraft parts, $1,221,400 certified with 50 pc allowed.

United Aircraft Corp., Pratt & Whitney Aircraft Division, East Hartford, Conn., military aircraft engines, $308,000 certified with 60 pc allowed and $202,000 certified with 65 pc allowed.

Douglas Aircraft Co., Culver City, Calif., military aircraft, $3,663,900 certified with 60 pc allowed.

The Firewel Corp., Buffalo, N. Y., military aircraft parts, $40,000 certified with 45 pc allowed.

Oscar Perry, Seattle, Wash., military aircraft parts, $7,982 certified with 70 pc allowed.

Kearfott Co., Little Falls, N. J., military aircraft instruments, $38,227 certified with 65 pc allowed.

B & H Instrument Co., Fort Worth, Tex., military aircraft parts, $30,000 certified with 55 pc allowed.

General Motors Corp., Oak Creek, Wis., research and development, $5,650,000 certified with 45 pc allowed.

Aircraft Engineering Products, Inc., Clifton, N. J., military aircraft parts, $3,469 certified with 70 pc allowed.

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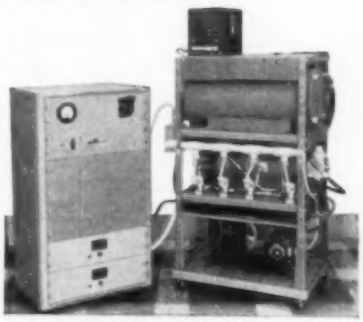
FOR TEST AND EVALUATION OF FLIGHT CONTROL EQUIPMENT AND INSTRUMENTS



Simulates actual altitude conditions of high performance aircraft or missiles in flight

Range—minus 1,000 to 80,000 ft
Max rate— 50,000 ft/min
Max response 10 cps

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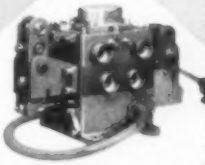

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SERVO ACTUATOR UNITS

● Custom designed integrated assemblies include actuating cylinder, electro-hydraulic servo valve and feedback sensing device. In a closed loop, actuator displacement is a function of input signal.

MOOG VALVE CO., INC.

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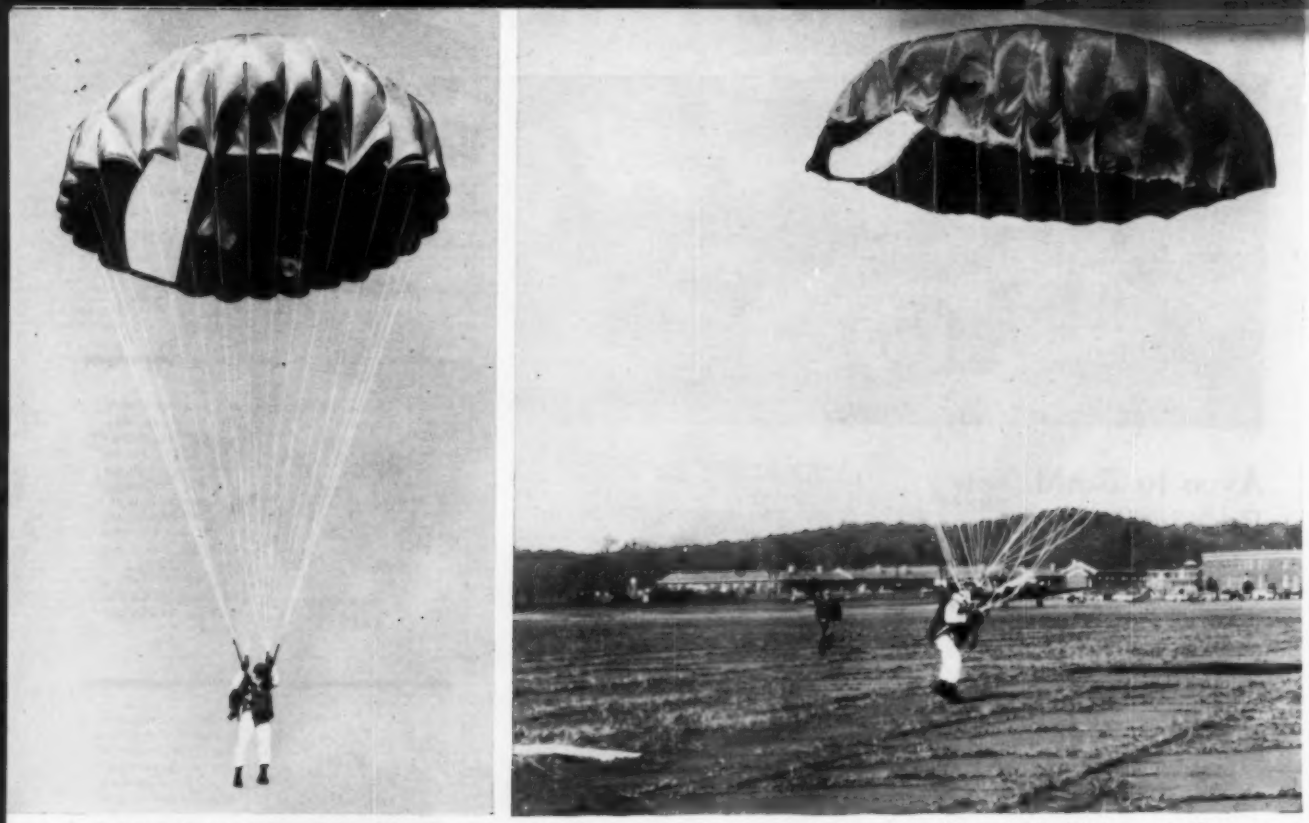

INDENTATION of skirts (left) of four front gores indicate forward motion imparted to the Soviet 'chute by the blank gore in the rear. Istel (right) is landing only a few yards from the X target, part of which can be seen in the lower left of the photo.

Sky Diving May Revise Armed Forces

By George L. Christian

New York—Sky diving—a relatively new parachuting technique in this country (AW Nov. 19, p. 98)—may bring about a major revision of our military reconnaissance capability if adopted by the armed forces.

Both the Marine Corps and the Army are interested in the new technique. Marine Reserve Capt. Jacques A. Istel gave a sky diving demonstration to Marine Corps officers at Quantico, Va. last month and was summoned to give a similar demonstration to Army officials at Fort Bragg, N. C., about mid-December.

Team Captain

Istel, who captained the team of American sky divers at the International Parachutists Meet at Moscow last summer, also demonstrated a Russian blank gore steerable 'chute in his exhibitions. (Istel acquired the Soviet parachute—the only one in this country—during his visit to Moscow). He also has a new type triangular parachute made in West Germany which is reported to be one of the first successful 'chutes of that design. He had not had a chance to try it out at this writing.

Istel told AVIATION WEEK he has reason to believe that U. S. reconnaissance-by-parachute techniques are far behind those of the Russians, long great believers in the military potential of the parachute. He feels that, by combining the free-falling techniques of sky diving with the directional, smooth opening and slow landing capabilities of the Russian blank gore 'chute canopy design, the U. S. can modernize its reconnaissance-by-parachute methods.

Of significance is the fact that the accuracy of the new, sky diving techniques is particularly adaptable to the new Marine attack concepts of vertical envelopment and separation of forces, both of which require highly accurate reconnaissance reports.

(To date, the Marine Corps has been non-committal on whether it will adopt the sky diving techniques as an official project.

(A Marine Corps spokesman in Washington told AVIATION WEEK that the service is interested in Istel's sky diving techniques since it is interested in any means of improving Marine Corps operations. He stated that sky diving allows a parachutist to do a more precise job of hitting an objective when jumping from high altitude than if he fell in the conventional, uncontrolled manner.

(The Marine officer added that areas in which sky diving may have a potential are such operations as pathfinder work—parachuting men in ahead of main attacking forces; and acting as underwater demolition teams of the future. As he put it, in the last war Marine amphibious operations involved landing on the beaches, in the next the Marines will go over the beaches.)

Istel said the three ingredients which sky diving can bring to reconnaissance are secrecy, silence and accuracy.

Current method of parachuting reconnaissance personnel is to fly them to destination in such aircraft as a C-119, C-123, or possibly a helicopter, and drop them from altitudes of 500-1,200 ft. The method is noisy, slow and only fairly accurate.

Istel envisions bringing the parachutists in at high altitudes—about 12,000 ft. or more—and dropping them from fast flying planes like, perhaps, the C-130. Istel said that it is feasible for the men to jump from jets, but that this would require a lot more planning, work and practice than currently has been done with sky diving in this country.

By coming in high, the noise of the plane is greatly reduced. The parachutists' plane might even fly in with

BACK PACK normally is used, chest pack being held for emergencies. In Istel's hand (left) is a home made streamer used to detect wind drift, made of a wire coat hanger weighted with lead, with crepe paper attached. Altimeter and stopwatch rest on parachute (right).

Parachuting

an aerial reconnaissance mission or a bombing raid to camouflage the mission.

The men free fall silently for a minute or more. Thus, when the 'chutes open, the planes are out of earshot.

The jumpers use sky diving body control techniques to direct themselves towards their targets and to avoid getting into uncontrollable and possibly fatal evolutions such as tumbling or spinning.

Sleeve Used

The parachutists open their 'chutes at about 800 ft. Use of a sleeve, which is pulled away from the main canopy by a pilot parachute, helps reduce the noise of the 'chute's opening.

After the parachutist's mission is accomplished he can be retrieved on the fly by an aerial pick-up system such as the one developed by All American Engineering Co., (AW Dec. 12, 1955, p. 76).

Istel estimated that accuracies of 200-300 ft. from target could be obtained consistently with jumps from 12,000 ft.

He emphasized, however, that this new sky diving technique does not apply to mass drops of troops.

Istel made two jumps for the Marine

ISTEL'S PARACHUTE opens after a sky dive of almost 6,000 ft. Chute is a Derry-type with two small vents. During the sky dive, Istel guided himself through one full figure eight while on way down. He missed target by 250 ft.

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ACCURATE TO ±1%

American Electronics
8108L Line Voltage Regulator
gives close regulation
with varying input and varying load

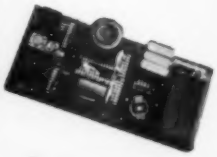
Accurate aircraft and missile performance demand an accurate power supply. The Model 8108L line voltage regulator controls power voltage to within ±1% with an adjustment range of 110 to 120 volts from no load to full load. The miniaturized 8108L is tubeless, employs silicon rectifiers and is shock and vibration proof.

Model 8108L—Magnetic Amplifier A. C. Voltage Regulator

SPECIFICATIONS

Voltage Regulation: ±1% with following variations
Input: 103-127 volts—390-410 cps
Output: No load to full load 1.0 to 0.9 p.f.
63% Recovery: 0.25 seconds
Duty cycle: continuous
Life Expectancy: 10,000 hours
Weight: 20 lbs.
Size: 5"x5 51/64"x6¾"
Environmental Conditions: Ambient Temperature Maximum: +160°F. Minimum: −65°F. Humidity, Altitude, salt spray, etc. to pertinent Mil Specs.

Input
Voltage: 103-127 volts
Frequency: 390-410 cps
Output
Nominal Voltage: 115 volts
Number of Phases: 1
(use 3 units for 3 phase applications)
Adjustment Range: 110-120 volt
Capacity: 150 VA
Power Factor: 1.0 to 0.9 lag
Frequency: same as input
Total Harmonics: 5% rms



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400 cps, 3428 rpm
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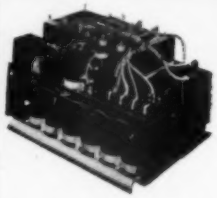

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Corps at Quantico. He said that many officers from the Tactics Board and Equipment Board were present to watch the jumps.

Plane used was a single-engine OE Cessna observation ship piloted by Marine Major R. Goeurley.

Gusty Weather

Winds aloft were erratic and blowing at about 20 mph. On the ground winds were gusty, ranging up to 10 to 20 mph.

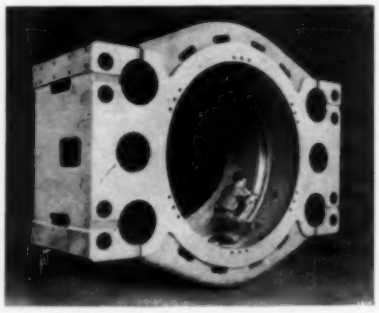
The first jump, a sky dive, was made with a Derry-type 'chute from an altitude of 6,500 ft. Istel delayed pulling the rip cord for 30 seconds, until he reached an altitude of about 950 ft. During the fall, he made a figure eight, then stabilized himself for the rest of the free fall. He missed the target by about 250 ft.

The second jump, a jump-and-pull leap, was made from 2,500 ft., using the Russian blank gore 'chute. In spite of the wind conditions, the 'chute's maneuverability enabled Istel to land within 12 ft. of the target.

OFF THE LINE

A complete application engineering service aimed at reducing materials handling costs is being offered by Lewis-Shepard Products, Inc. The Watertown, Mass., firm manufactures electric fork trucks and related equipment. The plan is designed to help companies who handle large quantities of materials to streamline their operation and to receive expert advice on such matters as equipment replacement and procedures improvement.

Jacques Andre Istel & Co (see page 90) has been awarded a public relations account by the basic parachute



Seventy-five Ton Platen

This 75-ton platen will house the main cylinder of a new 6000-ton capacity hydraulic, no-draft, forging press being built by Lake Erie Engineering Corp. for Prex Corp., of Franklin Park, Ill. The 30-ft. high machine has a bed measuring 60x108 in., a stroke of 48 in., and weighs 750 tons.

ICBM

"LIFE INSURANCE" The preservation of the peace and security of this nation depends upon two things: Our diplomatic wisdom in a troubled world, and the power to protect ourselves if peaceful negotiation should fail.

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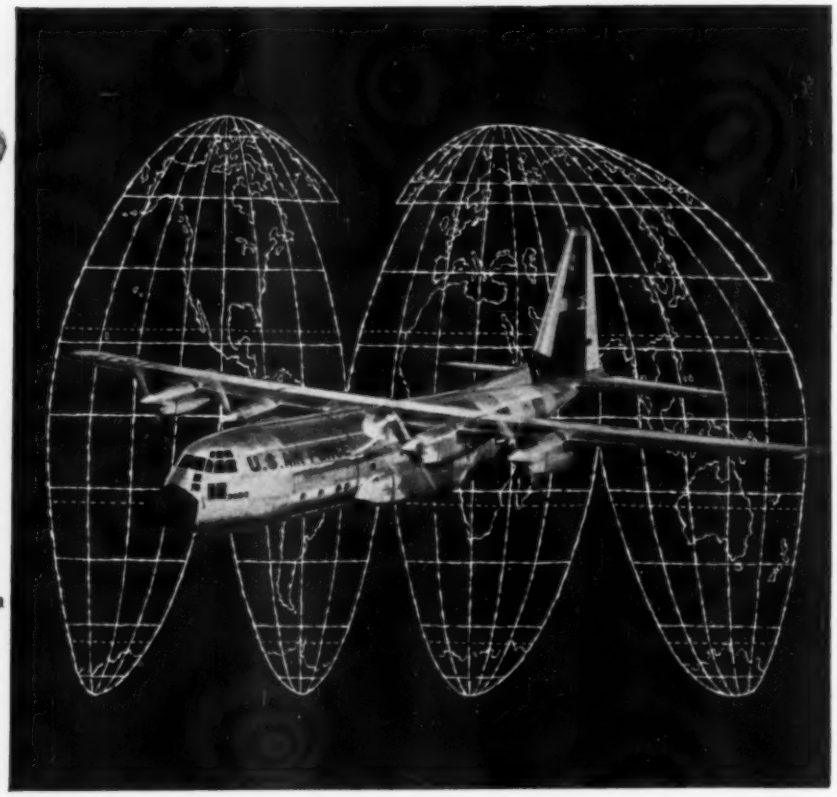

C-130 HERCULES

Delivered to 18th Air Force, Ardmore AFB

Moving anything, any time, any place on earth is the responsibility of Tactical Air Command's 18th Air Force. The new Lockheed C-130 Hercules–propjet "strongman" of the USAF, first assigned to the 463rd Troop Carrier Wing–does this job faster, better, at lower cost than any other combat carrier now in service. The Hercules is powered by four Allison T-56 propjet engines.

LOCKHEED *LOOK TO LOCKHEED FOR LEADERSHIP*

LOCKHEED AIRCRAFT CORPORATION, GEORGIA DIVISION:
U.S. Air Force Plant No. 6, Marietta; Georgia Nuclear Laboratory, Dawsonville

industry in the U.S. consisting of Pioneer Parachute Co., Inc., Manchester, Conn.; Switlik Parachute Co., Inc., Trenton, N. J.; and Irving Air Chute Co., Inc., Lexington, Ky. He also has a short duration consultant contract with the U. S. Army Quartermaster Corps.

MB Manufacturing Co., makers of vibration isolators for piston and jet aircraft engines and vibration generating equipment, have opened a western field service office. Address: 10816 Washington Blvd., Culver City, Calif.

Rubber Pressure Suit

Full-pressure pilot's suit developed for Navy Bureau of Aeronautics by Arrowhead Rubber Co., Long Beach, Calif., is now being produced by the company in limited quantities for fleet evaluation. A soft rubber garment, the suit features flexible bellows for joint mobility under pressure. Bellows are located at the shoulder, elbow, knee, thigh and hip. Helmet seals the garment completely and the pilot breathes oxygen from takeoff. Ventilated undergarment used with the suit is same as that developed for the Navy-Goodrich full-pressure suit (AW Oct. 15, p. 55). Arrowhead claims its full-pressure suit is the lightest of its type. It is the first full-pressure suit to be free-fall parachute-jumped from an aircraft.

Unusual aerodynamic design of the F-104A Starfighter gives this slim, razor-winged streak of fighter power the greatest combination of speed and flying performance ever built into a combat airplane. The high tail is a significant contribution to precision control... just as Camloc's 4002 Series quarter-turn fasteners on the F-104A's access panels are a significant contribution to security in flight and speed of maintenance ... Camloc quarter-turn fasteners open fast, close fast, hold fast!

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35 ton bomber gets carrier shakedown

Largest and most powerful aircraft ever to operate from a carrier deck, the Douglas A3D Skywarrior has now completed landing and takeoff tests aboard the U. S. S. Forrestal—the Navy's mightiest carrier. Able to deliver the A-bomb, at speeds above 600 mph, Skywarrior is designed to extend our carrier's striking range beyond any point yet reached.

U. S. Navy's atom bomber, the Douglas A3D Skywarrior

Continued advances in naval aircraft are meaningless without skilled fliers at the controls. If you are interested in a career as a Naval Aviator, drop a card today to *Nav. Cad., Washington 25, D. C.*

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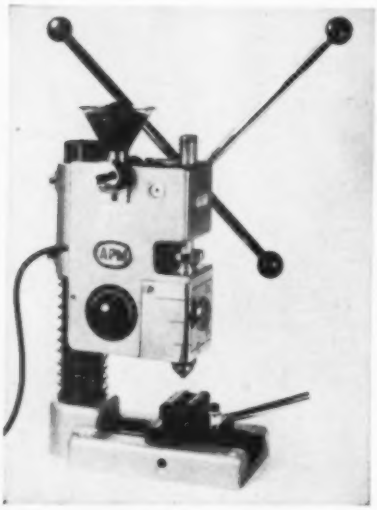


Injection Molds for Plastics

Low cost plastic injection molds in a wide range of sizes and materials may be run on portable bench-type machine called Asmidar APM 21. Mold machine is hand operated and economical for test and short production runs. It has semi-automatic hopper feed and patented leak-proof, self-sealing, interchangeable cylinder. Cam lock vise holds molds of various sizes and thicknesses.

Ram and cylinder are made of heat-treated and chromium plated alloy steel for long life and clean operation. Sunvic heat controller mounted on side of casting is operated by rotary knob that has finely divided scale. Thermometer is held in direct contact with cylinder by brass collar. Cast aluminum body and base is finished in hard stove enamel.

Injection pressure is 5,700 psi.

British Marine and Foundary Supplies Ltd., Dept. PR-14, 80 Shore Rd., Port Washington, N. Y.

Conductive Silicone Rubber

Electrically conductive silicone rubber is superior to conductive organic rubber in that it can easily be molded, calendered or extruded without changing its electrical properties. It is called X-1516 Silicone Rubber Compound. Because of its resistance to temperatures up to 400F it can be used for such applications as anti-fogging heater pads or aircraft cameras. Other possible applications are shielding for silicone insulated wire, static grounding fueling hose and industrial pressure rolls capable of being electrically heated or of dissipating static. Like other silicone rubbers X-1516 is thermally stable, inert, and resists weather, corona and ozone. It can be produced with electrical resistivity less than 100 ohm-cms.

Silicone Division, Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y.

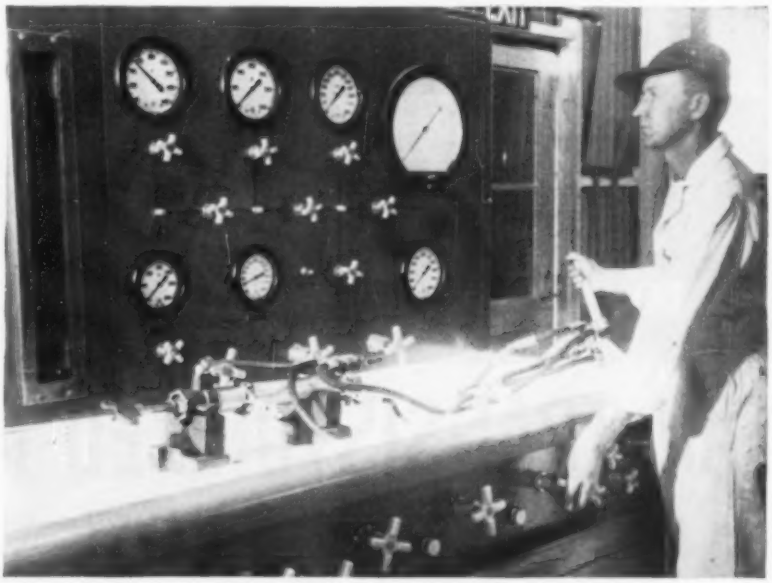
Gyro Rotor Alloy

High strength, high density alloy for gyroscope rotors called Mallory 1000 Gyromet is said to have considerably higher stability and strength than earlier rotor materials. Permissible rotor speeds are 25% higher, permitting gyroscopes to be designed to smaller size. Greater stability should be useful for inertial guidance applications where great precision and uniformity are needed. Gyromet is a sintered alloy of tungsten, nickel, copper and small amounts of other elements. It has a density of 16.70 to 17.05 gm/cc. Proportional elastic limit is 62,000 psi. Modulus of elasticity in tension is 44 x 106 psi. Endurance limit is 55,000 psi. It is readily machined and is available in a variety of stock forms and sizes.

P. R. Mallory & Co. Inc., Indianapolis 6, Ind.

Metal Protecting Spray

Aluminum alloy test strip coated with Sclinizing Fluid, a silicone resin dispersion in compatible organic solvent, has withstood 2,000 hr. exposure to salt spray (ASTM-B117-42T . . . QQ-M-151a) without evidence of base metal attack. Fluid was sprayed on, air-dried and baked for one hour at



Oil Flow Operation

Hydraulic test stand that will check out oil flow operation of aircraft valves up to 20 gpm. and valve pressures up to 3,000 psi, has been added to The Garrett Corp.'s AiResearch Aviation Service division. Test equipment enables AiResearch to overhaul hydraulic systems in any aircraft up to Convair and DC-7 range. Two-position control bench will handle two pressure operations or three flow operations simultaneously. Test capabilities on hydraulic valves and cylinders include high pressure static test (to 1,000 psi), leakage test in cubic centimeters, timing test, return oil pressure test and controlled oil temperature. Normal operating range up to 3,000 psi is provided by a three-phase, 40 hp. power pack. By using a handpump the test range can be increased to a maximum of 10,000 psi. The stand will also check gauge calibrations up to 6,000 psi.

first to get off the ground in jet transports–

LEAR TRANSISTORIZED AUTOPILOTS

AT THE VERY DAWN of the jet transport age, Lear automatic flight controls are already in the air guiding Air France's Caravelle jet transports on route indoctrination air freight runs. And when the Caravelle enters regularly scheduled passenger service next year, an all-transistorized airliner autopilot, the Lear L-17, will be at the controls. This will be the first all-transistorized autopilot in airline use.

And for the United States Air Force, a Lear L-10 autopilot in the Boeing KC-135 jet transport tanker will provide the rock-steady sureness of flight required for the most exacting of all aerial maneuvers: air-to-air refueling of a bomber at jet speeds. In automatic flight controls for the new military and airline jets, Lear is again first in concept, first in production... to meet tomorrow's precision needs of aviation today. LEAR INC., GRAND RAPIDS, MICHIGAN IP-11

480F before being put in the salt box. The coating is 0.2 mill thick and has shown no loss in adhesion during testing. Cost averages 2 to 3 cents per square foot in normal applications. It has been successfully applied to many materials, both cast and wrought, and at baking temperatures as low as 250F. The coating has been described as hard, durable, flexible, transparent and tightly adherent. It has been used as a release agent to keep frozen meat from sticking to aluminum trays.

Selinizing Process Co., Houseman Bldg., Grand Rapids, Mich.

Mach Flow Computer

Rapid calculation of compressible flow problems is possible with circular Variable Density Computer. Timed studies show that accurate solutions can be had with computer in one-tenth the time required by older techniques. Based on one dimensional flow theory, it permits the evaluation of total pressure loss in any flow system and the determination of fluid properties at any point in the system. Computer consists of 17 flow scales on one side and 17 slide rule scales on the other.

Pickett & Eckel, Inc., 5 S. Wabash Ave., Chicago, Ill.

Ultrasonic Soldering Iron

Low-cost ultrasonic soldering iron is capable of soldering without flux by completely removing all oxide film on the metal surface. It is useful for soldering aluminum and other metals which form refractory oxides that cannot be removed by flux. Oxide film is removed to permit wetting action by the solder by transmitting ultrasonic vibrations through molten solder. Vibrations produce imploding cavitation bubbles which remove oxide film. Soldering iron can be replaced by tinning bath which operates on same power unit.

Acoustica Associates, Inc., Glenwood Landing, L. I., N. Y.

Heat Exchanger

Tiny heat exchanger cools airflow to pilot's high altitude suit in Navy F4D. It is part of a dry air pump installation which provides an independent pressure supply for the suit. Before entering suit, pressurized air is cooled by passing through heat exchanger. Cooling air flow across exchanger is moved by small fan. Exchanger is made of aluminum and is of plate fin or extended surface

Tow Target Test

Air Research and Development Command (ARDC) tests tow targets by attaching to center of large helicopter rotor blade which has been counterbalanced to distribute load. Rotor blade is accelerated until simulated speed of 200 knots is imposed. Target is observed visually on closed television circuit, rotation can be stopped at any desired point to recover target for close examination. Target shown is made of nylon metalized with silver.

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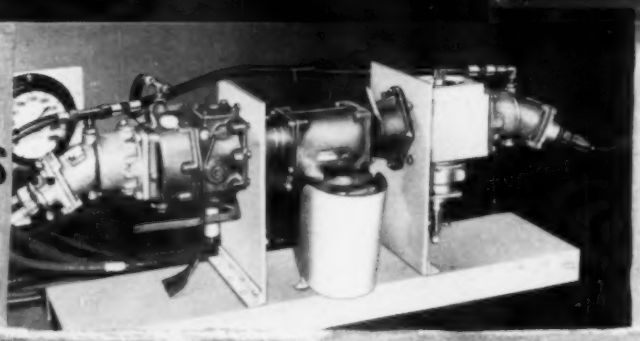
Transistorized circuitry

LEAR

These are units

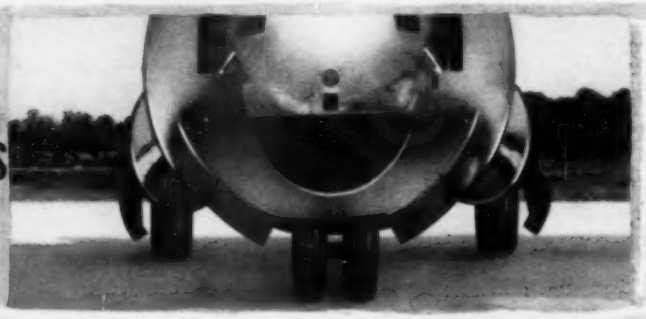
(by Western Gear)



that are part of the system...

(also by Western Gear)

that lowers the wheels



on the plane that Lockheed built

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construction. It is capable of lowering temperature of air inside suit by 50F. from between 90 and 150F. with minimum cooling flow. Air flow through the suit is variable from .25 to 1.5 lb./min. and can control internal temperature to within 10 F. of ambient. Exchanger weighs less than a pound. Housing measures 4 x 3.75 x 2.25 inches. It meets requirements of MIL-E-5272A.

AiResearch Manufacturing Division, The Garrett Corporation, 9851 Sepulveda Blvd., Los Angeles 45, Calif.

ALSO ON THE MARKET

Model S10/S18 Ferrite Load Isolator, engineered for minimum size and weight, provides 18 db isolation over a 300 MC band width from 2,500 mcs to 3,000 mcs. With waveguide flanges, maximum insertion loss is 1.0 db; maximum input VSWR is 1.5. Unit can handle up to 500 KW peak power and 250 w. average without external cooling. –Litton Industries, Components Division, 5873 Rodeo Rd., Los Angeles 16.

Traffic signal for airport control towers, supported by an overhead trunnion and yoke, can be operated with one hand; it meets the requirements of CAA Specification 508. Signal weighs 6 lb., 9 oz., and measures 10 in. long x 14 in. high. By means of a concentrating type parabolic searchlight reflector, unit reflects a high intensity beam of 50,000 candlepower.–Crouse-Hinds Co., Wolf & 7th North St., Syracuse, N. Y.

A2507 one-lug cap seal anchor locknut is designed for integral aircraft fuel tanks in which space for riveting is limited or where bolt holes are close together. Item prevents leakage up to 50 psi on either side of the seal. It conforms to MIL-N-25027 (ASG) requirements for torque, tensile, twist-out and push-up performance.–Elastic Stop Nut Corporation of America, Union, N. J.

Aircraft trim material of vinyl coated Dynel fabric, for headliners, side panels, wainscoting, etc., is fire resistant, easily tailored, light weight and mildewproof. Material is available in standard 44 in. width, in a range of interior colors.–Sawyer-Tower, Inc., Stanley Ave., Watertown 72, Mass.

Aminco Strand Burner will measure burning rates of explosive and jet and rocket fuels to the closet .01 second, in nitrogen atmosphere, under high pressure. Four models are available with variations in pressure ratings: 19,000; 4,000; 7,500; and 2,000 psi. Electric current is passed through the nichrome heating element. to ignite the test strand; as flame passes successive binding posts, timer clocks are activated to determine exact burning rates.–American Instrument Company, Inc., Silver Spring, Md.

WHAT'S NEW

Publications Received:

Aerodynamics, Propulsion, Structures–by E. A. Bonney, M. J. Zucrow and C. W. Besserer–Edited by Grayson Merrill, Captain, USN–Pub. by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, New Jersey. $10.00; 595 pp.

Second volume in the series "Principles of Guided Missile Design", covers the design fundamentals of missile supersonic aerodynamics, means of propulsion and structural design.

Research is People–Copyright by Industrial Research Institute, Inc.–For sale through New York University Press, Washington Square, N. Y. 3, N. Y. $4.00; 69 pp.

Proceedings of a symposium held during the April 1956 meeting of the Industrial Research Institute. A discussion of the recruitment, motivation,

NEW MODEL 21 AMERICAN MECHANICAL INERTIA REEL HAS WIDE ANGLE OF INERTIA RESPONSE

An entirely new shoulder-harness take-up reel, built and approved under Spec. MIL-R-8236A, Type MA-1.

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The Flying Years—by Louis Reichers—Pub. by Henry Holt and Company, 383 Madison Ave., N. Y. 17, N. Y. $4.50; 384 pp.

Mr. Reichers, who retired as a lieutenant colonel in the Air Force, tells the story of his career in aviation.

The United States Air Force Dictionary—Edited by Woodford A. Heflin—Pub. by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. $4.75; 580 pp.

Compiled through the facilities of the Research Studies Institute of the Air University, this is a dictionary of the new language of the air.

New Era of Flight, Aeronautics Simplified—by Lewis Zarem and Robert H. Maltby—Pub. by E. P. Dutton & Co., Inc., 300 Fourth Avenue, New York 10, N. Y. $3.75; 176 pp.

Clearly written, understandable photo book on military aviation compiled for the purpose of simplifying the subject for young readers.

Viscous Flow Theory I—Laminar Flow—by Shih-I—Pub. by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, New Jersey. $7.75; 400 pp.

Thorough study of laminar flow of viscous, compressible fluids with special attention to aerodynamics and other engineering applications.

Reports Available

• **Tensile Properties of Aircraft Structural Metals at Various Rates of Loading After Rapid Heating** (PB 121137)—by C. L. Dotson and J. R. Kattus—Prepared by Southern Research Institute for Wright Air Development Center, and available from OTS, U. S. Department of Commerce, Washington 25, D. C. $4.50; 174 pp.

Variables of strain rates from 0.00005 in./in./sec. and holding times at test temperatures from 10 seconds to 30 minutes were used to test the tensile properties of seven aircraft structural sheet metals after being heated to temperatures up to 1200F within 10 seconds. The results are shown.

• **Conference on Materials and Design for Low Temperature Service** (PB 121009)—Prepared by Engineer Research and Development Laboratories, U. S. Army, and available from OTS, U. S. Department of Commerce, Washington 25, D. C. $10.00; 400 pp.

Valuable in particular as a background guide for designers and fabricators of low-temperature equipment, the volume is a compilation of pre-

1952 data, but one of the few comprehensive collections of material on the subject.

• **Aviation Cartography, A Historical Bibliographic Study of Aeronautical Charts**—by Walter W. Ristow—Pub. by the Library of Congress, and available from the Card Division, Library of Congress, Washington 25, D. C. $.85; 114 pp.

As the title indicates, this book includes an historical summary and a bibliography of aviation cartography.

• **Note on the Nilson Method of Variable Supersonic Wind Tunnel Design**—by M. M. Callan—laboratory report LR-174 of the National Aeronautical Establishment, Montreal Road, Ottawa, Ontario, Canada, 64 pp.

The Nilson method of nozzle design is discussed and extended, and from the results obtained in calculations based on the method, certain tests for the basic function used in the development are suggested.

• **A Review of the Air Force Materials Research and Development Program** (PB 111648S)—by Mary M. Sokas, Wright Air Development Center, U.S. Air Force, $3.50; 137 pp.

This publication is supplementary to two other volumes, also available from OTS, of the same title. They are PB 111648, covering Air Force

Ropelock

A new tensioning device, called Ropelock, has been put on the market by Aeroquip Corp. Designed to be used with ¼ in. nylon or manila rope, the device eliminates tying and untying knots in rope thus simplifying and speeding up the securing of cargo where rope tie-down is involved. The Ropelock automatically maintains whatever tension is applied to the rope without allowing any slack through the use of a single cam, the device's only moving part. Maximum tensions the Ropelock will hold are 1,000 lb. with nylon and 700 lb. with manila rope. Load can be instantly released by depressing the cam. Ropelock, which retails for less than one dollar, is manufactured by General Logistics, 900 South Fair Oaks Ave., Pasadena, Calif.

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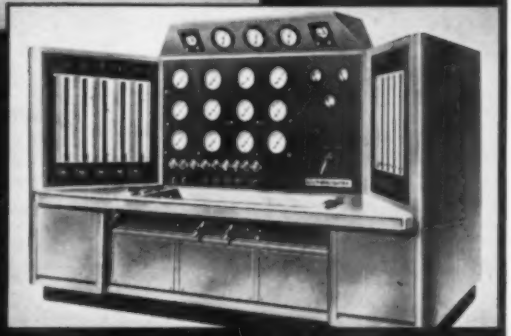

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A message to engineers from an engineer-president

Marquardt was incorporated in 1944 by five engineers and three Los Angeles businessmen to explore the potential of the ramjet engine – then merely a laboratory curiosity.

Twelve years of sound engineering and research have really paid off. Today we employ over 2000 people at Los Angeles and Ogden, Utah and expect to triple in the next two years. Of course, many of our new associates will be in manufacturing –which is fine. Every engineer wants to see his "baby" accepted and in production. However, the outstanding work of our present engineering and research team has also opened up big new requirements for engineers in almost every specialty in areas varying from production engineering and qualification testing of present models to advanced research on startling new break-throughs in high speed propulsion – new chemical fuels and nuclear energy.

It is not too late to get in on the ground floor on engineering the ramjet engine – the powerplant of the future. Write me personally.

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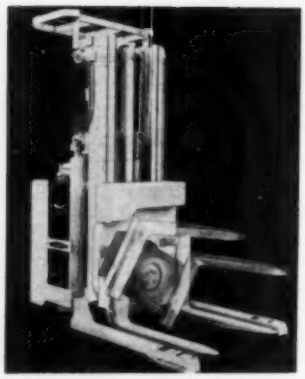

Fork Dump Truck

This electric fork truck incorporates a mechanism which allows the operator to rotate the forks through 360 deg. in either direction to dump small parts from containers into hoppers. Movement is controlled by a hand-operated hydraulic valve. The rotating assembly can be installed on any 4,000 lb. capacity fork truck produced by the manufacturer. Address: The Raymond Corp., Greene, N. Y.

materials research from July 1, 1953 to June 30, 1954, $2.75, and PB 111537, covering the 10 years of research prior to July 1, 1953, $3.75.

• **Collection of Papers Presented at the Colloquium in Statistical Design of Laboratory Experiments** (PB 121181) –Prepared by Naval Ordnance Laboratory, $2.75; 102pp.

• **A Flight Test Investigation of the Sonic Boom** (PB 121312)–by M. E. Mullens, Air Force Flight Test Center, Edwards Air Force Base, $1.00; 40pp.

• **First Joint Military-Industry Packaging and Materials Handling Symposium** (PB 121350)–A record of the proceedings, including over 30 papers presented at the symposium, $6.00; 695pp.

• **Report of NRL Progress,** published monthly by the Naval Research Laboratory, can now be obtained on a subscription basis. Annual rates are $10.00 domestic, $13.00 foreign. Single issue price is $1.25. Orders should be addressed to OTS, U. S. Department of Commerce, Washington 25, D. C.

Each issue of the publication contains articles and "problem notes" concerning current NRL non-classified research and development.

• **A Study of Magnesium Fire Extinguishing Agents** (PB 121375)–by L. M. Greenstein and S. I. Richman, Francis Earle Laboratories, Inc. for Wright Air Development Center, $3.75; 149pp.

A SEVEN-JET B-47?

In this case, yes. The seventh jet, in the rear fuselage pod-mounting shown above, will be Orenda's Iroquois, designed for supersonic speeds.

The Boeing B-47 is on loan from the United States Air Force for flight testing the Iroquois in the initial subsonic phases.

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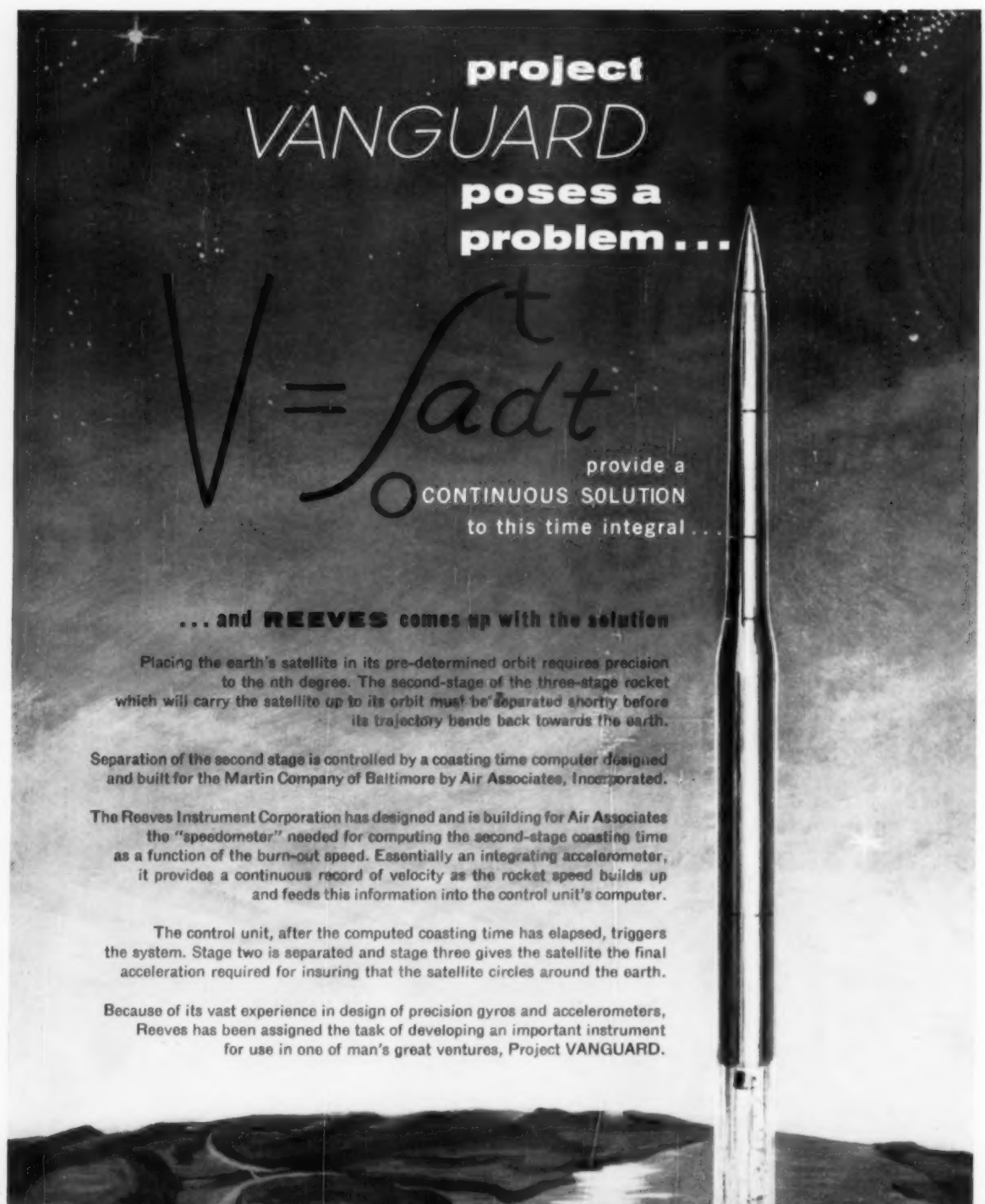
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Placing the earth's satellite in its pre-determined orbit requires precision to the nth degree. The second-stage of the three-stage rocket which will carry the satellite up to its orbit must be separated shortly before its trajectory bends back towards the earth.
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The Reeves Instrument Corporation has designed and is building for Air Associates the "speedometer" needed for computing the second-stage coasting time as a function of the burn-out speed. Essentially an integrating accelerometer, it provides a continuous record of velocity as the rocket speed builds up and feeds this information into the control unit's computer.
The control unit, after the computed coasting time has elapsed, triggers the system. Stage two is separated and stage three gives the satellite the final acceleration required for insuring that the satellite circles around the earth.
Because of its vast experience in design of precision gyros and accelerometers, Reeves has been assigned the task of developing an important instrument for use in one of man's great ventures, Project VANGUARD.
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USAF PRIMARY TRAINING PICTURE changes next year when Cessna T-37A jet teams with Beech T-34A to replace T-28A (background).

USAF's Contract Training Saves Money

By Erwin J. Bulban

Mission, Tex.—USAF's Air Training Command is saving American taxpayers an estimated $11.5 million annually with its civilian contract concept for pilot primary training.

Efficiency of the operation may further be measured by these figures: the nine schools operated by the civilian contractors require a total of only about 6,500 civilian and 300 Air Force personnel. One contractor estimates that the same organization, if run by the military, would take some 27,000 officers and airmen.

Average Cost

Air Training Command, Maj. Gen. H. R. Spicer, commanding, notes that in the first five years, January, 1951, through December, 1955, the nine civilian-operated primary flight schools have trained 39,612 students, graduated 27,602 at an average cost per graduate of approximately $9,000. Through this period, operating costs have gone up only about 12%, despite changes in equipment, increased length of courses, pay increases and the like.

Facilities at all nine schools are similar. Air Force aims at a uniform layout as much as feasible so as to maintain a reasonable basis for comparing the operations periodically and providing a competitive spirit among them. Each school operates some 150 aircraft, 50 Beech T-34As and 100 North American T-28As.

To provide incentive, Flying Training Air Force, commanded by Maj. Gen. G. P. Disoway, rates all schools annually in four areas: aircraft accident rates, attrition rates in primary, quality of students graduated as shown by their attrition in basic and excellence of contract management.

Based on these ratings, an incentive fee of 10 cents per student flying hour is paid the first three ranking schools and five cents an hour bonus to the next three schools. This is over the fee of 65 cents to 95 cents per flying hour under Fiscal 1957 contracts covering the schools' Beech T-34As and North American T-28As. Data covering the current year are not yet available, but figures covering the last few calendar years, compiled by the Aeronautical Training Society, show that the contractors have been making an average net profit of $32,000 after taxes, with the net profit percentage on gross receipts after taxes being .864%.

Contract procurement is handled by Air Materiel Command; contract administration by Flying Training Air Force.

Incentive bonuses notwithstanding, FlyTAF does not hesitate to turn on the pressure to accomplish its training mission. An example of this occurred in Fiscal 1954, when following a reduction in the standard training fee, Gen. Disoway told the contractors that they had to maintain the planned pilot goal without cutting training quality. The result: contractors lopped 550 civilians from their payrolls.

Moore Typical

Typical of the civilian contract primary training schools is Moore Air Base, an 11,956-acre facility with three 5,000-ft. runways near Mission, visited recently by newsmen under the aegis of Air Training Command and the Aeronautical Training Society, an association of operators handling military contracts.

Comprising 732 civilian and 35 Air Force personnel, Moore is operated by California Eastern Aviation, Inc.,

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Homebuilt Plane Is "Flying Jigsaw"

Tiny homebuilt sport plane took Chester Koslowski of New Jersey two years to build in his spare time, utilizing parts of various planes. Wings, 65-hp. Continental engine, propeller, landing gear and tail group came from a Taylorcraft L-2; Piper Cub and Waco components were fitted as needed. Builder Koslowski says his experimental "Short T" is a little tricky to fly; indicates it requires nearly full-throttle operation. Top wing spans 18 ft.; lower wing 16 ft.; length is 17 ft. Cruise speed is approximately 90 mph. Fuel is carried in two six-gallon cells in the top wing and a two-gallon tank in fuselage.

headed by S. J. Solomon. Initially an airfreight carrier, which operates nine four-engine transports for Military Air Transport Service from West Coast to the Far East and between West and East Coast for the Navy, CEA also owns Land-Air, Inc., electronics engineering and installation firm and Air Carrier Services Corp., sales agent for airframe and equipment manufacturers and purchasing agent for several foreign airlines.

Operations Rugged

CEA entered the Air Force primary training field in 1951, opening a facility at Columbus AFB, Miss. Starting operations there was rugged. One employe remembers jacking up his first airplane with four-by-sixes and using buckets to fuel aircraft.

CEA had to vacate Columbus in 1954 to make room for Strategic Air Command. It moved to its present quarters in the Rio Grande Valley, spending $2,205,000 to rehabilitate a former World War II advanced flying school. It is now one of the top businesses in the area, with a payroll of $600,000 monthly.

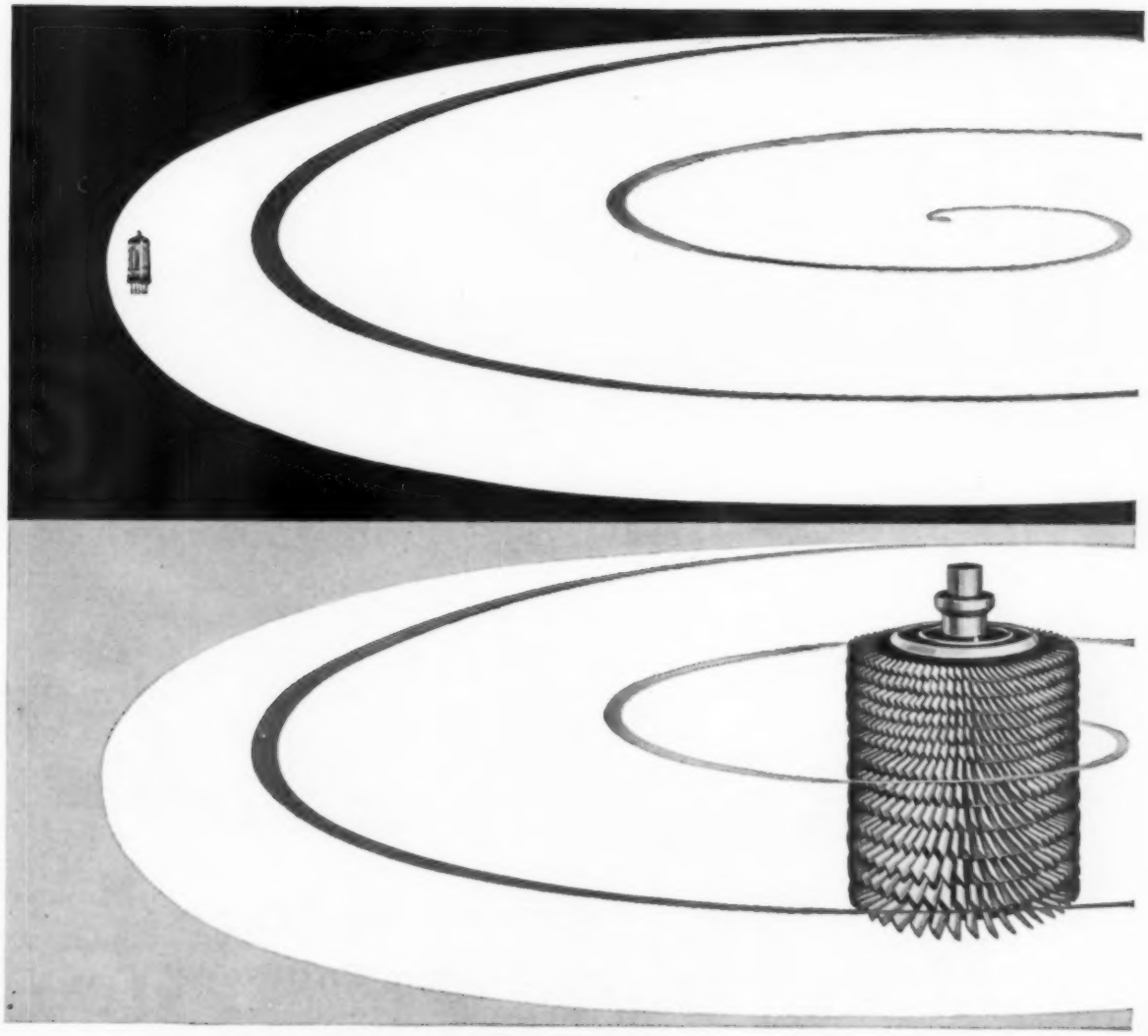
The primary flight training course here takes 24 weeks. The 140 flying hours are split 40 hr. on the Beech T-34A and 100 on the T-28A. There also are 245 hr. of academic training. Flying time is broken down thus: T-34A—12½ hr. pre-solo, 23½ hr. contact proficiency and four hours aerobatics. T-28A—8 hr. pre-solo, 39 hr. contact proficiency, 15 hr. navigation of which 6½ are night flying, 25 hr. instrument flying, 7 hr. aerobatics and three hours optional work. Students also receive 25 hr. simulated instrument training in a Link.

Some 80% of the 435 Moore students arrive with Air Force ROTC commissions, and with wives. Moore gets a high percentage of married students because good housing is available. Air Force and instructing personnel agree that the caliber of students is high. Gen. Disoway at FlyTAF headquarters says that it is the highest since depression days and is the reason Air Force faces such big problems in retraining personnel—industry can pay higher than the Air Force for this quality. The quality shows up in primary attrition rates, which has fallen from approximately 35% five years ago to approximately 22%. Major accidents are down to one per 100,000 hr. of student flying.

Curriculum Changes

When the jets move into the contract schools, which should begin late next year, some changes in curriculum will be made. Just how the program will finally work out may depend largely upon an experimental jet training course recently started at Laredo AFB, Tex., where students are flying the Lockheed T-33A directly after finishing the light Beech T-34A, skipping the second phase of primary on the T-28A (AW Dec. 10, p. 33).

One program revealed by FlyTAF headquarters, Waco, Tex., shows that primary students are scheduled for 50 hr. on the Beech T-34A, 10 hr. more than they get now, prior to going to the new twin-jet Cessna T-37A, which will



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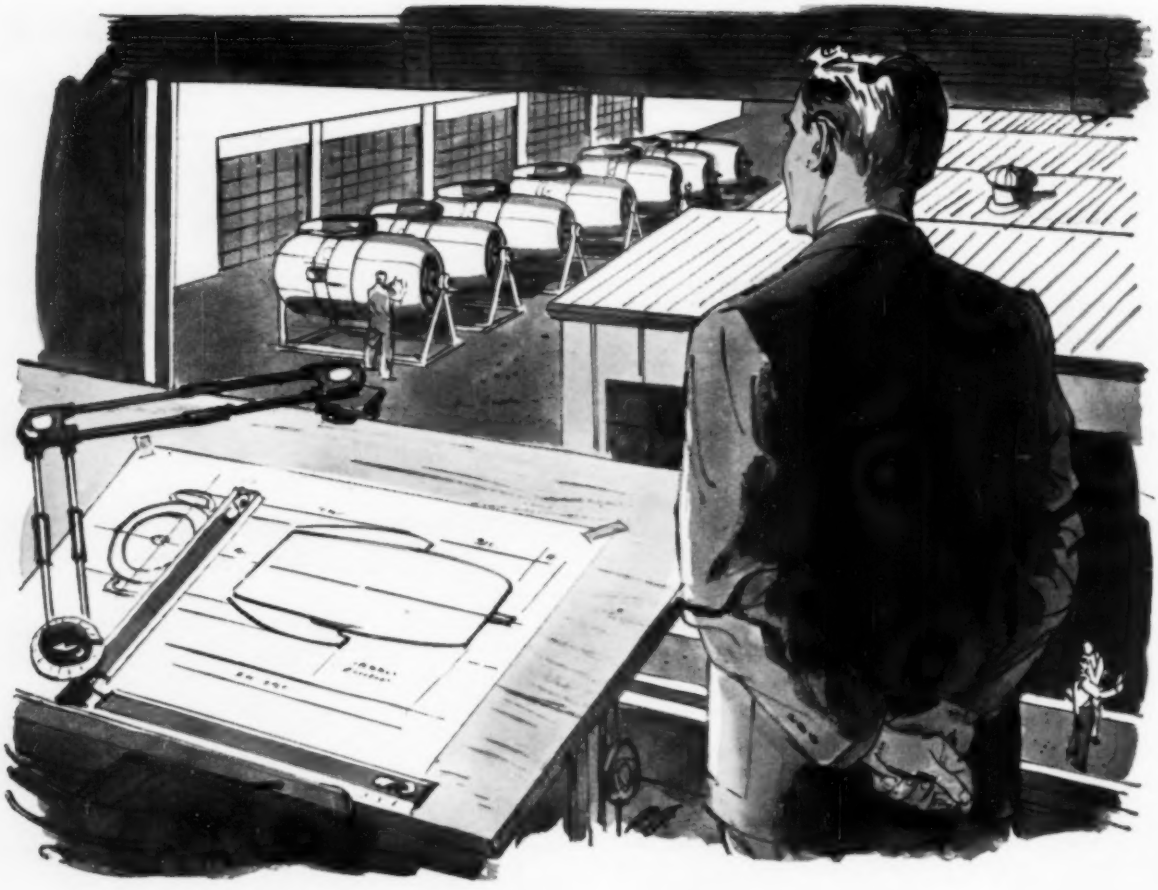

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replace the T-28A. The plant shows that they are slated for 150 hr. on the Cessna jet, compared to the 90 they are now getting on the T-28A. The course is stretched from six months to seven months. FlyTAF, with its eyes on an all-jet training curriculum, even now is thinking of starting the student in the T-37A, then putting him on the T-33A. In basic he would go to the new Northrop T-38 supersonic trainer for a six months course of 110 flying hours.

Keeping the aircraft flying at a training school is a big load, because, as James McLachlan, maintenance superintendent at Moore points out, "If you don't fly, you don't get the 'dollar'."

McLachlan's 220-man maintenance crew keeps the T-34As and T-28As flying an average of 475 hr. a day, which also calls for pumping some 20,000 gal. of avgas daily. At the time of our visit he had 96 airplanes of a fleet of 153 on the field, the remainder out for maintenance, and inspection and repair as necessary (IRAN).

His schedule called for availability of 65 T-28As in the morning, 63 in the afternoon; 39 T-34As in the morning and afternoon. This calls for considerable attention to maintenance schedule. He told AVIATION WEEK that he has to plan to put five or six T-28As and three or four T-34As daily through major inspections.

Self-Sufficient Pattern

An ex-Marine Corps aviation maintenance man, who has also spent time in United and Tranocean Air Lines' shops, McLachlan planned his shops to follow the near self-sufficient pattern of the airlines as closely as possible and within USAF limits. For example, the shops can go up to major overhauls on engines; this work is performed outside by Slick Airways in San Antonio.

McLachlan noted that the North American T-28A's 800-hp. Wright R1300-1A engine provided a major maintenance problem due to what he calls inadequate cooling, causing the cylinders to run hot on the exhaust side and resulting in compression losses. The problem has been compounded by a shortage of R1300 cylinders, although he said the situation is beginning to ease up. Average engine time between changes at Moore for the R1300 was 725 hr., he stated. McLachlan appeared pleased with the performance of the small Beech T-34A and its 225-hp. Continental engine.

Moore's shops seemed to contain plenty of test equipment. McLachlan pointed out that ability to bench-check instruments, electronic gear, a.c. motors and the like sharply cut down the need for shipping material to USAF depots for overhaul. He figured that his shops were able to recover about 60% of the instruments brought in.

CAP Training Goes to Congress

A nationwide civilian flight training program that would provide approximately $5 million of revenue annually for U. S. fixed base operators will be placed before Congress by the Civil Air Patrol.

Initiation of the program must await Congressional authorization and appropriation of necessary funds. Phase one, providing 500 flight training scholarships to CAP cadets at a cost of approximately $250,000, could be started next September if Congress passes the necessary legislation in the next session, according to Gen. Walter R. Agee, national commander of Civil Air Patrol and active-duty Air Force officer Gen. Agee states that the Air Force has endorsed the CAP proposal.

35 Hr. Minimum

Essence of the plan is a flight course providing a minimum of 35 hr. and maximum of 42 hr. of flight time. The course consists of 20 flight lessons comprising 17 hr. dual and 18 hr. solo, with a maximum of 20 hr. and 22 hr. respectively. Flight time would in-

Dearest Peg:

It's with heavy heart and tear-fogged optics that I write you the tragic news from Southwest Airmotive: After five glorious, glamorous years, SAC this month ends its world-famous "girl ads." However, I'm cheered by a pledge that their 1957 Silver Jubilee ads may be even more exciting--and not entirely un-feminine. I'm cheered, too, by five years of wonderful memories of all the lovely ladies who've smiled out at me from the nation's aviation magazines. God bless 'em every one! And a very special Christmas blessing to my own 20-year-old, 5'4", 115 lb., green-eyed, blonde daughter.

Love,

Daddy

NOTE: Daddy's right. This is it! Our grand finale here shows a princess representing each of our five series: L. to R., Sally Merrill, Dee Brock, Peggy Martin, Nancy Boyd Gibson, and Barbara Allard. AS A MEMENTO FOR OUR COUNTLESS FRIENDS, WE HAVE A FREE BROCHURE WITH ALL 12 "LETTERS FROM DADDY". THE SUPPLY IS LIMITED. WRITE NOW FOR YOURS!

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clude a minimum cross-country time of eight hours dual country and 13 hr. solo; the solo cross-country including two intermediate full-stop landings, with one leg of the flight being at least 100 mi. The program is intended to turn out pilots meeting Civil Aeronautics minimums as regards handling an airplane and as near as possible commercial qualifications concerning navigation, weather, radio, flight planning and cross-country.

Professional Instructors

Ground schooling will be provided by individual CAP squadrons using paid professional instructors teaching a standardized course. CAP recently completed a series of six texts, training films and recordings which will form the basis for the ground instruction. The material will be made available to the organization's 3,000 units.

Gen. Agee stated that all instruction will be given by CAA-qualified instructors who have been in business at least one year. Each operator will be asked to work within a "reasonable" radius of his school and provide instructors for remote areas. A CAA agent will monitor each CAP cadet at the end of 20 hr. of instruction and a flight examiner will give the final check for a private license.

Operators will be paid $500 per CAP cadet trained; half paid when the student passes the 20-hr. check ride, the remainder when he receives his private license. For washouts, the operator will be paid a predetermined rate for dual and solo time; maximum flying time which will be permitted before washout wil be 12 hr. dual and eight hours solo.

Scholarship Basis

Flight training will be provided to CAP cadets in their third year of training on a scholarship basis; during his first and second year the cadet will receive aviation education and orientation flights.

The program would start in the Southwest region, comprising Texas, Oklahoma, Mississippi, Arkansas, Louisiana, New Mexico and Arizona with 500 scholarships. This phase would provide fixed base operators in this region with $250,000 of business this first year.

In the second year, it would become nationwide, providing 2,000 flight training scholarships; then each year for the next three years, the number of students will be increased until CAP is providing flight training for 10,000 cadets annually.

Development of the new flight program started in 1954 wtih appointment of a research committee by Gen. Carl (Tooey) Spaatz, chairman of CAP's executive board.

PRIVATE LINES

Instrument training for 108 commissioned pilots of the Sixth Army will be started by Taloa Academy of Aeronautics, Oakland, Calif., Jan. 7. U. S. Army contract calls for Taloa to supply 11,000 hr. instrument flight instruction and 13,000 hr. ground instruction through Dec. 6, 1957.

Cooperative promotional and advertising agreement has been developed by National Air Taxi Conference and National Car Rental System to pool efforts in developing common markets. National Air Taxi Conference members comprise over 135 members located at about 200 airports; National Car Rental has an international network of nearly 400 offices and some 10,000 vehicles.

Bungartz & Co., Munich, is German representative for the Italian Bonmartini track-type landing gear designed to permit aircraft operation into rough airfields.

U. S. helicopter exports in the first 10 months of 1956 totaled 159 units valued at $25,300,985, with 21 of these being shipped in October valued at approximately $5 million. Europe received 126 helicopters in the Jan.-Oct. period, 21 went to Western Hemisphere export markets and 12 to other overseas customers. Shipments do not include new and used rotary wing aircraft shipped overseas by owners or dealers, for MDAP or the Armed Forces.

Modification kit to improve Fairchild C-82 single-engine performance is being developed by Steward-Davis, Inc., Los Angeles, Calif. Kit will cost between $40,000-$50,000 and availability is planned for early February.

Outline for teaching aviation courses has been sent to all high schools in the state of Washington by the Department of Public Instruction. Special committee, headed by Creighton Merrell, president of Washington State Aviation Assn., prepared the outline. The course is designed to provide science credits for either one or two semesters and will qualify pupils to take Civil Aeronautics Administration written examination for private pilot certificate.

Decommissioned airway beacon lights are available at no cost to any public agency that will continue their operation as an aviation aid. Lights are being taken out of service to divert federal funds to more modern facilities. Requests for the beacon lights should

Teacher Builds Roadable Plane

Flying testbed of a roadable personal plane that cruises at 85 mph. in the air and does 50 mph. on the road is being developed by Dr. Lewis A. Jackson, faculty member at Central State College, Ohio. By unlocking a single pin, the 18 ft. 4 in. wing is rotated spanwise above the fuselage, reducing overall width to 7 ft. 6 in. Prototype was built from Piper J-3, J-4 and Aeronca components and has a 720-lb. empty weight. Gross weight is 1,150 lb. Spill plates on lower wings and tubular fence guards around the nose reduce propeller hazards while vehicle is on the ground, Dr. Jackson reports. He is now improving the basic layout to provide increased performance and four-place seating. Current version, designated Versatile I, is powered by an 85-hp. Continental engine. Dr. Jackson started its development in 1950, testing small model airplanes prior to building the present full-scale version.

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be made to Civil Aeronautics Administration regional administrators; where a beacon will be dismantled and relocated, CAA will retain the tower for installation of other navigational aids.

Helicopter delivery service of urgently needed ship, marine and communications cable will be made by Normandy Electric Wire Corp., Brooklyn, N. Y., from its new warehousing facility, where the company has set aside a heliport area.

Vickers Viscount 700D personal transport is being used by the President of Brazil following delivery to the Brazilian air force Nov. 7th. A second Viscount is scheduled for delivery to the air force next year.

Fairchild C-82 modification kit to enable the airplane to be operated at full military gross weight of 54,000 lb. and meet CAA transport category 04b is being developed by Stewart-Davis, Inc., Gardena, Calif.

New fly-in bank, facing the apron of Sky Harbor, Phoenix, airport is serving Arizona cattlemen, mining and business executives. The First National Bank building also serves number of industrial plants in the airport's vicinity.

Spray/dust operators using Pensalt L-10 (arsenic acid) defoliant are cautioned to guard against leakage; experience shows that the material deteriorates fabric, metal and cable. Control cables have broken on bending after one week's exposure to the defoliant.

Philadelphia will be the finish point for the 1957 All-Woman Transcontinental Air Race (Powder Puff Derby) to be held next July. Starting point will be San Mateo County Airport, Calif., eastern terminus North Philadelphia, Pa., airport. At least 50 aircraft and 100 women pilots are expected to participate. For further data write: All Woman Transcontinental Air Race Headquarters, 2611 E. Spring St., Long Beach 6, Calif.

Colombia Petroleum Co., Cucuta, Colombia, will install P&W R1830-94 engines purchased from Steward-Davis, Inc., Gardena, Calif., in its DC-3 business aircraft fleet.

Reading Aviation Service, Inc., Reading, Pa., is now eastern distributor for X-band and C-band radomes made by McMillan Industrial Corp., Ipswich, Mass. The mounting brackets on the Reading installation are designed to take either Bendix, Collins or RCA radar equipment. McMillan is currently

expanding radome commercial production to include radomes for the C-46, Lodestar, Convair-Liner and DC-6.

North Dakota Aeronautics Commission reports increase of 85% in number of agricultural planes and 400% in acreage sprayed from the air in last eight years. State reports 277 licensed agricultural aircraft. Total acreage sprayed this year was 1.5 million. Increase in fatal accidents is noted. Of the total of five in past eight years, there have been three in last two years.

Air mapping of all of Cuba starts next month under a $1,100,000 contract awarded by the government to Aero Service Corp., Philadelphia, Pa. The firm will use two modified P-38 photo planes flying at 30,000 ft. to gather material for 324 map sheets covering the entire area. Aero Service expects to deliver the first maps late in 1958 and complete the entire project in 1959.

SWIVEL BULKHEADS in GE business plane ease cargo loading, can be located fore or aft.

GE Engineers Use Modified C-54

General Electric engineers engaged in an aircraft nuclear propulsion program are using a specially modified Douglas C-54 for expediting trips between plant and research installations.

A combination passenger/cargo business plane configuration was designed and modified by Temco Aircraft Corp.'s Greenville, Tex., conversion center. Temco engineers planned the C-54 to handle these basic requirements:

- **Take GE personnel aboard** at Cincinnati, Ohio, near the company's Evendale engineering center, at the end of their day's work, provide them with an evening meal, conference accommodations, overnight sleeping facilities and allow them to have breakfast preparatory to their putting in a day's work at the Atomic Energy Commission test bed at Idaho Falls, Idaho.
- **Provide cargo facilities,** including heavy and concentrated loads, separated from the passengers.

To combine maximum utility with comfort, standard sky felt was used in place of the conventional plush headlining material to cover the interior. Lightweight seats were installed on tracks extending the entire length of the main compartment. Seats are of the full-reclining type which fit together to provide sleeping bunks. They were tested to conform with Air Force and civilian load limit requirements for fore, aft or combination placement. Overhead baggage racks were not installed.

Seat tracks were designed to provide support and tiedown fittings for heavy cargo. The main compartment is fully carpeted, with the floor covering cut so that it can be removed entirely or in sections depending on the loading plan.

To provide passenger/cargo separation, a portable bulkhead was designed that can be placed in either of two positions, aft of the passenger section or midway of the main compartment. The split bulkhead is designed so that both sections can be swiveled parallel with the aisle, forming a six-foot-wide opening to allow easy cargo loading. One section has a hinged door for access past the bulkhead.

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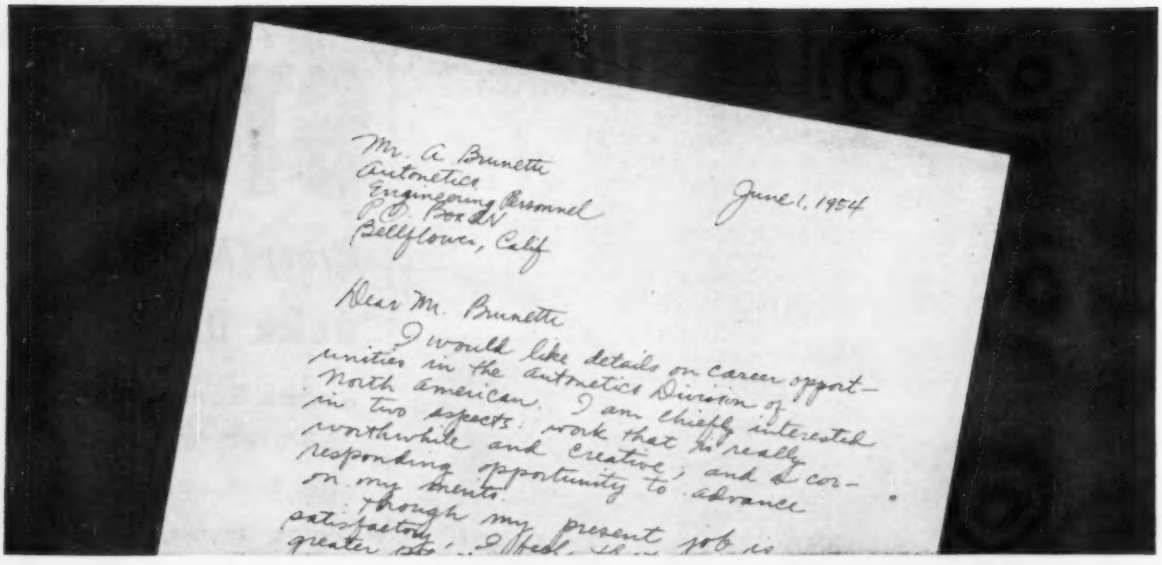
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CAB Accident Investigation Report:

PV-1 Stalled Too Low For Recovery

A Lockheed PV-1, N 2000C, owned and operated by the Swiflite Aircraft Corp., crashed and burned at 1633[1] on Jan. 26, 1956, three miles west of Smithtown, L. I., N. Y. Three pilots, the only occupants, were killed and the aircraft was destroyed by impact and ground fire.

N 2000C took off at 1625 on Jan. 26, 1956, from MacArthur Field, Ronkonkoma, L. I., N. Y., its home base, on a local flight with three pilots. They were Bernard J. Malloy, check pilot, and pilots Raymond Hamberg and Hugo D. Filangeri. The purpose of the flight was to qualify Pilot Hamberg on the Lockheed PV-1 aircraft, a type he had never piloted.

The takeoff of N 2000C was normal, toward the northwest, and made under VFR (Visual Flight Rules) conditions with Pilot Hamberg occupying the left or captain's seat and Pilot Malloy, as check pilot, seated on the right as copilot; Pilot Filangeri acted as observer. Subsequently the PV-1 was seen over the Smithtown area, flying westerly at an estimated altitude of 2,500-3,000 ft., where a witness reported that the engines sounded normal but that the aircraft appeared to be flying at a slow airspeed.

Witnesses stated that shortly thereafter the engine power sounded as though it was cut momentarily and then came back on. At an altitude of approximately 2,000 ft. the aircraft was seen to dip down and pull up, slightly nose-high, and then fall off to the left, making two to three turns of a descending spiral, and disappear behind the tree-topped horizon. Flames erupted from the woods over the point where the aircraft was last seen, followed quickly by a large column of black smoke.

INVESTIGATION

N 2000C was found to have crashed and burned on the northerly side of a wooded knoll at about 200 ft. msl. (mean sea level) three miles west of Smithtown and three-fourths of a mile north of the Jericho Turnpike. The accident occurred at 1633, eight minutes after takeoff from MacArthur Field.

Impact marks revealed that after striking the top of a slender 40-ft. tree, at an angle of descent of about 40 deg., the PV-1 first struck the ground on its left side with the left wing down about 45 deg., followed by the nose section, and both engines, and on a fuselage centerline heading of 205 deg. Impact destruction was extensive. Both wings were partly crushed and severed from the fuselage and both engines were torn from the nacelles. The steep angle of descent into the ground confined the aircraft wreckage to an area 93 ft. long and approximately 50 ft. wide.

Ground fire broke out immediately after impact and completely gutted the fuselage and center section. A considerable portion of the entire control system was destroyed, and remainder did not reveal any control system irregularities. Because of the almost complete destruction in the cockpit area, the settings of controls, instruments, and trim tabs could not be determined. Other components such as the tail section, landing gear, and scattered pieces of wreckage showed evidence of intense heat but there was no indication whatsoever of inflight fire.

The position of the actuating cylinders indicated that all three landing gears were retracted. Both wing flaps were fully retracted. The flap actuating cylinder, with the piston at the top of the cylinder, provided corroborative evidence that the flaps were fully retracted when the PV-1 struck the ground.

FIRE DESTRUCTION

Both engines were severely damaged by impact and extensively destroyed by fire after-impact. Although the power sections of both engines were burned dry by ground fire, examination of the interiors did not reveal any evidence of inflight failures. Nine pistons, four from No. 1 engine and five from No. 2 engine, were consumed by fire but all the remaining pistons of both engines failed to reveal any evidence of pre-ignition, detonation, or engine overspeeding.

Examination of the combustion chambers of all cylinders available disclosed that all were capable of normal operation. The crankshafts of both engines, although bent, were intact, as were the counterweight assemblies. Examination of these assemblies revealed no evidence of overspeeding or operational distress.

Both propellers suffered major impact damage. All blades, except No. 2 on the No. 1 propeller, were bent rearward in varying degrees, indicating a power-off condition at the time of the crash. This power-off evidence is also supported by the propeller dome positions and the blade shim plate markings which revealed that the blade angles of both propellers were at 26 deg., the low pitch position for this propeller installation. This 26-deg. low pitch position of the propeller blades can be obtained by a reduction of engine power, or loss of engine power and aircraft speed.

A review of the maintenance records of N 2000C revealed no discrepancies. Flight logs covering the year of operation prior to the accident disclosed no repetitious mechanical malfunctioning, and all pilot report items of mechanical difficulties had been readily and properly corrected. The aircraft was released for flight on the day of the accident, following completion of a 100-hr. airframe and engine inspection.

Pilot Filangeri conducted the preflight examination of the aircraft and subsequently it was test flown for approximately 40 min., from 1440 to 1520, by Pilot Malloy with Filangeri, who had recently been promoted from copilot-mechanic to pilot. Pilot Hamberg, who had been observed sitting in the PV-1 while it was on the ground, familiarizing himself with the cockpit and equipment, accompanied the crew as an observer on this test flight, his first ride in a PV-1 type airplane. No discrepancies or "squawks" were found on either the Preflight Check Sheet or the Test Flight Check Sheet and so far as is known no complaints were voiced by the crew during the one-hour interval on the ground between the test flight and the last flight of N 2000C.

LAST CONTACT

The flight first called MacArthur Tower and asked permission to make a test run on runway 28, which was granted. Then takeoff instructions for a local VFR flight were requested and the tower cleared N 2000C to runway 32 where a normal takeoff was made. This was the last radio contact the tower had with the flight. All radio communications between the tower and the aircraft were normal. A periodic inspection of radio installations and equipment on board the PV-1 had been completed satisfactorily the previous day.

The gross weight of the PV-1 on takeoff at 1625 was 26,259 lb., which was 4,741 lb. under the maximum allowable gross takeoff weight, and the center of gravity was located within prescribed limits. The fuel on board was computed at 1,004 gal.

At 1630, three minutes before the aircraft crashed, the U. S. Weather Bureau recorded a ground observation from MacArthur Field as: ceiling estimated 4,000 broken, 6,000 overcast; visibility 15 mi.; temperature 31; dewpoint 18; wind north 10 kt.

Pilot Hamberg, who had been hired by the Swiflite Aircraft Corp. eight days previously, was being given familiarization in the PV-1 so that he could obtain a rating to fly this type airplane. Two days before the accident he had satisfactorily passed a flight check on the company's DC-3.

The company did not have written instructions on basic operating procedures and pilot training. There was no policy regarding pilot seating during initial check flights or familiarization flights. Flight training of company pilots usually consisted of slow flight, single-engine operation, single-engine landings, and other maneuvers aimed at familiarizing the pilot with the operating characteristics of a specific type airplane.

ANALYSIS

The duration of the flight was only eight minutes and though witnesses' estimates of altitude during the last portion of the flight are below 3,000 ft., the performance capabilities of the aircraft and weather conditions (ceiling 4,000 broken, 6,000 overcast) would have permitted VFR flight at higher altitude. It is entirely possible that the

[1]All times herein are eastern standard and based on the 24-hour clock.

G. D. Schott (center), Flight Controls Department head, discusses a rocket control system with Group Engineer R. A. Fay (right) and F. G. Hudson, missile components research specialist.

FLIGHT CONTROLS THEORY

The transition from theory to reliable components is one of the most difficult phases of flight controls endeavor. At Lockheed Missile Systems Division, engineers and scientists are performing advanced work on a number of theoretical approaches that offer important practical solutions.

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Lockheed **MISSILE SYSTEMS DIVISION**

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aircraft was at 3,500 ft., or higher, at the time of beginning any maneuvers demonstrating performance of the PV-1, such as slow flight.

It is evident that the aircraft did descend from a higher altitude and then was observed to enter a spiral or start of a spin from a stall.

Full recovery from this condition was not accomplished before ground contact.

The investigation covered all control factors to the fullest extent that the intense ground fire damage permitted. The possibility of exterior control locks, incapacitation of the crew, and control interference by foreign objects was investigated but with negative results. Impact and fire damage could have destroyed evidence of control interference.

Damage by ground contact and fire precluded an accurate determination of engine operation.

The examination of the engines indicated that they had been capable of developing normal power prior to the accident. Had power interruption occurred, without loss of control, the open areas below were suitable for emergency landings.

Normal and safe procedures had been followed before the subject flight as shown by the 40-min. test flight in which Pilot Hamberg acted as observer, the time spent by him on the ground in cockpit familiarization, and the practice takeoff roll made on runway 28 just before the actual takeoff.

According to experienced PV-1 pilots, stalls in this type aircraft are "extremely severe" and considerable altitude is lost before recovery. It appears that in this instance the pilot, while practicing familiarization maneuvers, permitted the aircraft to stall at a low altitude.

FINDINGS

Upon consideration of all available evidence, the Board finds that:

1. The crew and aircraft were currently certificated.
2. The takeoff weight of the aircraft was more than 4,000 lb. under the maximum gross weight and the load was properly distributed.
3. Weather was not a major factor.
4. The altitude probably did not exceed 3,500 ft. above the ground during the eight minutes the aircraft was in the air.
5. There was no fire prior to impact.
6. There was no evidence of failure of the airframe or malfunction of controls as far as could be determined.
7. There was no evidence of power failure of either engine.
8. The purpose of the flight was pilot familiarization and included slow flight.
9. The aircraft was observed to stall at low airspeed approximately 2,000-2,500 ft. above the ground.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was loss of control resulting in a stall at an altitude too low to effect recovery.

By the Civil Aeronautics Board:

(s) Joseph P. Adams
(s) Harmar D. Denny
(s) G. Joseph Minetti

Durfee, Chairman, and Gurney, Member,

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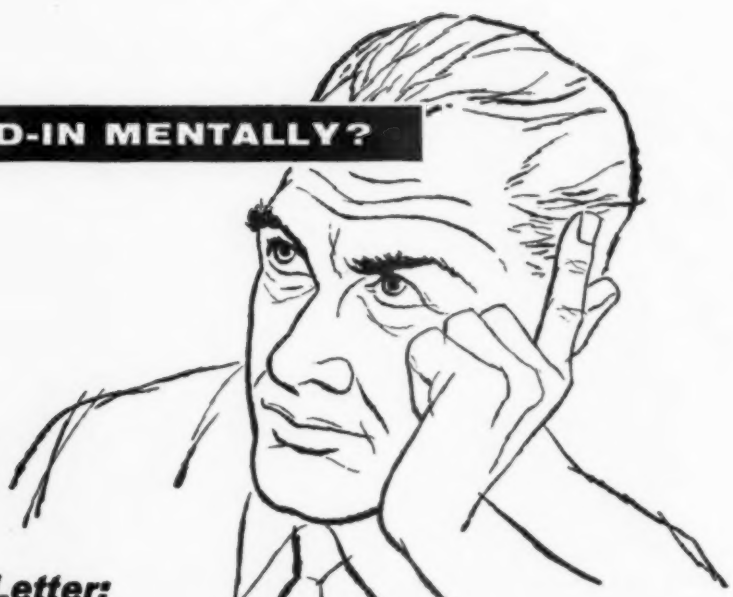

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ATOMIC ENERGY DIVISION

did not take part in the adoption of this report.

The Civil Aeronautics Board was notified of this accident at approximately 1700, Jan. 26, 1956. An investigation was immediately started in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended.

AIRCRAFT OWNER

The Swiflite Aircraft Corp., a subsidiary of Cities Service Oil Co., has headquarters at 60 Wall Street, New York, N. Y., and an office at MacArthur Field, Ronkonkoma, L. I., N. Y. The company owns several transport type aircraft that are used to transport company personnel throughout the United States.

FLIGHT PERSONNEL

Capt. Bernard J. Malloy, age 39, held a currently effective airman certificate with ratings of commercial pilot, instrument, airplane single- and multi-engine land, and type ratings on Douglas DC-3 and A-26, Lockheed 18, and PV-1. He was employed by the parent company Jan. 28, 1947. Capt. Malloy had approximately 6,600 flying hours, of which 237 hours were in PV-1 aircraft. His last Class-2 physical examination was passed on Nov. 16, 1955.

Pilot Hugo D. Filganeri, age 33, held a currently effective airman certificate with ratings of commercial pilot, airplane single- and multi-engine land, and instrument. He was employed by the company Aug. 13, 1951.

Pilot Filganeri had approximately 800 pilot hours, of which 600 hours were in PV-1 aircraft. His last CAA physical examination was on Oct. 10, 1955.

Pilot Raymond Hamberg, age 33, held a currently effective airman certificate with a rating of airline transport, and type ratings on Douglas DC-3 and DC-4. He was employed as a pilot by the company on Jan. 19, 1956. Pilot Hamberg's flight time was approximately 5,800 hours, of which only the subject familiarization flight was on Lockheed PV-1 aircraft.

THE AIRCRAFT

Lockheed PV-1, N 2000C, serial 5243, was manufactured in 1943 for the U. S. Navy. It was purchased from the Quaker Rubber Company on Sept. 10, 1953. Total airframe time was 2,216.25 hr., with 1,458 hr. since major overhaul, and 40 min. since the last 100-hr. inspection. The aircraft was equipped with two Pratt and Whitney model R2800-31 engines and two Hamilton Standard model 23E50-505 propellers with model 6477A-12 blades. Time on the engines since overhaul was 149 hr. and 67 hr. Time on the propellers since overhaul was 447 hr.

Republic Passes Out Christmas Bonus

Farmingdale, N. Y.—Republic Aviation Corp. was scheduled to pass out its 15th annual Christmas bonus for employes, amounting to $1,917,000, this week. The bonus is equivalent to one week's pay for each of the 18,000 employes of the company.

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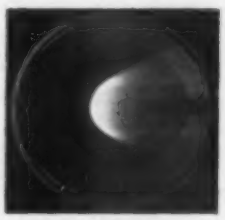

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AMC Contracts

Wright-Patterson AFB, Ohio—Following is a list of unclassified contracts for $25,000 and over as released by the Air Materiel Command:

General Electric Co., West Lynn, Mass., $1,078,732 for facilities for the production of B-52 components.

Hughes Aircraft Co., Culver City, Calif., $1,038,224 for IRAN of Falcon weapons system items.

Shaw and Estes, Dallas, Texas, $2,766,407 for turbo-jet engine test stands and kits.

Curtiss-Wright Corp., Wood-Ridge, N. J., $2,476,440 for R3350-32W engines data and special tools.

Eastman Kodak Co., Rochester, N. Y., $2,363,683 for photographic film.

Gilfillan Brothers Inc., Los Angeles, Calif., $1,723,892 for spare components of radar set AN/NPN-11.

Raytheon Manufacturing Co., Waltham, Mass., $1,425,600 for electron tubes transmitting magnetron.

General Aniline and Film Corp., Binghamton, N. Y., $1,035,541 for photographic film.

Douglas Aircraft Co., $3,419,933 for modification of B-66 series aircraft. Place of performance, Long Beach, Calif.

Continental Motors Corp., Muskegon, Mich., $1,016,673, for packette engines and data.

Glenn L. Martin Co., Baltimore, Md., $877,609 for modification and repair of B-57 aircraft.

United Aircraft Corp., Pratt & Whitney Aircraft Division, East Hartford, Conn., $8,750,000 for turbojet engine development.

Glenn L. Martin Co., Baltimore, Md., $10,800,000 for facilities in support of the guided missile program.

E. I. Du Pont de Nemours & Co., Wilmington, Del., $2,964,916 for methenol.

General Electric Co., Utica, N. Y., $2,897,436 for transmitters and receivers.

Glenn L. Martin Co., Baltimore, Md., $2,594,750 for electronic reconnaissance set.

Hallicrafters Co., Chicago, Ill., $2,401,690 for electronic counter measure sets.

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

BUREAU OF AERONAUTICS, Washington 25, D. C.

Motorola Inc. (Phoenix Research Laboratory), 3102 N. 56th St., Phoenix, Ariz., PP-1063/DPN power supply, noas 56-338-f (PD-33-2737-55), 125, **$37449.**

Lear, Inc., (Grand Rapids Div.), 110 Ionia Ave., N. W., Grand Rapids, Mich., overhaul tools and test equipment, noas 56-565-f (MA-3604556-56), $1506947.

Philco Corp., 4700 Wissahickon Ave., Philadelphia 44, Pa., modification kits no. 463-3804, noas 56-649-f (PD-31-825-56), 125, $54676.

Sperry Rand Corp., (Sperry Gyroscope Co. Div.), Great Neck, N. Y., fabricate and furnish direct-reading spherical attitude indicators, noas 56-669-f (AE-73-1918-56), 8, $33465.

Zenith Plastics Co. (Zenith Aircraft Div.), 1600 W. 135th St., Gardena, Calif., design fabricate and furnish 150 gal. reinforced plastic external fuel tanks complete with sway braces, noas 56-669-c (AE-663-1829-56), 25, $57070.

Emerson Radio & Phonograph Corp., 14th and Coles Streets, Jersey City 2, N. J., APA-16 capacitor units, control units, marker units mounting bases and plates, noas 56-706-f (PD-36-802-56), 33, $64161.

Radio Corp. of America (Defense Electronic Products), Camden 2, N. J., feasibility study and construction of breadboard model take-off from the antenna of the AN/FPS-16(XN-1) radar set, noas 56-786-d (EL-762-2777-56), $32152.

Audio Productions, Inc., 630 Ninth Ave., New York 36, N. Y., motion picture train-

ing films, noas 56-823-f(PH-5-2520-56), 5, $60948.

American Machine and Foundry Co., 509 W. North Street, Raleigh, N. C., development of remotely activated reserve high voltage primary batteries, noas 56-826-c (EL-50-1301-55), $36020.

Piasecki Aircraft Corp., Island Road, International Airport, Philadelphia 42, Pa., plan and design an automatic stabilization and command system for hovering type aircraft, noas 56-890-c(AE-11-1936-56), $156664.

NAVY PURCHASING OFFICE, 1206 South Santee St., Los Angeles 15, Calif.

Electro-Mechanical Research, Inc., Ridgefield, Conn., components for telemetry station, N123(60530)3332A, Sch52381-5/14/56), 44 ea, $52350.

AVIATION SUPPLY OFFICE, 700 Robbins Ave., Philadelphia 11, Pa.

Hoover Electric Co., 2100 S. Stower Avenue, Los Angeles 25, Calif., actuators for FJ-2, 3 A/C (383/2110-78/55, 383/2110-239/54), 193 ea, $94570.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N.J. polar path compasses used on R4D A/C (PREN11-4755/56), var, $29003.

Control Products Inc., 306 Sussex Ave., Harrison, N.J., fire detector controls for UF-1 & F9F A/C (383/2140-2707 E4/3/52), 5007 ea, $49319.

Pioneer-Central Div., Bendix Aviation Corp., Davenport, Iowa, kit used on 1648-6U-A6-1 indicators (383/2120-785/52), 3700 ea, $41144.

Kell-Strom Tool Co., Inc., 214 Church Street, Weathersfield, Conn., tools to repair aircraft propellers, (383/2160-54s2/5/53), 119 ea, $38145.

Pioneer-Central Div., Bendix Aviation Corporation, Davenport, Iowa, parts for various regulators, (383/2150-1219/52), various, $396688.

Arnold O. Beckman Inc., Pasadena, Cal., oxygen analyzers, (383/29081-1688G3/8/56), 35 ea, $32200.

U. S. Electrical Motors Inc., Box 2058 Terminal Annex, Los Angeles, Cal., 36 CT, motor, (383/2140-1976/52), various, $43684.

American Alkyd Industries, Broad & 14th St., Carlstadt, N. J., alkyd resin solution, (IFB 383-1580-56), 814000 lbs, $121205.

American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., alkyd resin solution, (IFB 38301580-56), 1080000 lbs, $161676.

Rubbercraft Corp. of America Inc., 151 Orange Avenue, West Haven, Conn., pneumatic lift rafts, (IFB 383-1374-56), 1555 ea, $606179.

Patten Co., Inc., 1803 N. 10th Ave., Lake Worth, Fla., Multiplace life rafts, (IFB 383-1374-56), various, $175099.

Atlas Paint & Varnish Co., 32-50 Buffington Ave., Irvington 11, N. J., enamel, (JD IFB-383-1458-56), 19500 gal, $42900.

West Liberty Lumber Co., 1211 W. Liberty Avenue, Pittsburgh 26, Pa., plywood dart tow targets, (IFB 383-1229-56), 2500 ea, $238638.

Flight Refueling Inc., Box 1701 Friendship International Airport, Baltimore 3, Md., gear boxes, governor, nozzle assys. (383/2150-1581X4/3/52), var., $26715.

Sierra Tool & Mfg. Co., Inc., 4310 San Fernando Road, Glendale 4, Cal., actuators, (383/2110-236/54/AERO), (383/2110-75/55), 68 ea, $35882.

Hardman Tool & Engr. Co., 1845 S. Bendy Drive, Los Angeles 15, Cal., seats used for various aircraft, (383/2110-1947/52/AERO), var, $80503.

Transco Products Inc., 12210 Nebraska Ave., Los Angeles, Cal., valve assys., (JD 383/2110-935/53/AERO), 257 ea, $42405.

Airesearch Mfg. Co., The Garrett Corp., 9851-9951 Sepulveda Blvd., Los Angeles 45, Cal., various assemblies used on WV-2 aircraft, (383/2110-1932/52/AERO), various, $131402.

New York Rubber Corp., 100 Park Ave., New York 17, N. Y., rafts, (IFB 383-1376056), 1321 ea, $42113.

Newport Industries, Inc., 230 Park Ave., New York 17, N. Y., turpentine, (IFB 383-1691-56), 60000 gals, $49941.

The Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron 16, Ohio, wheel

Picture of a young man

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- Aircraft maintenance background desirable.
- Must be competent pilot.

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- Must develop and administer a spare parts merchandising program.
- Must aid dealers in setting up and operating parts departments.
- Must have automotive parts experience on zone manager level.

CESSNA

If you meet these requirements and are interested in an unlimited opportunity with the World's Leading Producer of Executive Aircraft, send your resume and recent photograph to the Professional Placement Supervisor Dept. AW, Cessna Aircraft Company, 5800 East Pawnee Road, Wichita, Kansas. (No phone calls, please.)

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Here is an outstanding opportunity for two men possessing a minimum of five years experience in engineering and planning. Additional requirements are two years background in aircraft or missile development, including one year field test experience.

Planning background should consist of experience in general system planning and detailed test layouts. Applicants must be capable of analyzing general problems and developing detailed test plans. In addition the ability to direct the work of a small group of planners in a coordinated effort is required.

EDUCATION:

BS in engineering—electronics major preferred.

Masters Degree in engineering, physics, mathematics, or business helpful.

SEND RESUME TO

Chrysler Corporation
Missile Operations
Personnel Department
P.O. Box 2628
Detroit 31, Michigan

assys. (383/2110-2136/52/AERO), 130 ea, $28755.

Douglas Aircraft Co., Inc., 3000 Ocean Park Blvd., Santa Monica, Cal., yoke assys. (383/2110-2116A4/3/51/AERO), 80 ea, $29527.

The Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron 16, Ohio, wheel assys. (383/2150-1555X1/3/52/AERO), 250 ea, $44053.

Sherwin-Williams Co., 325 N. Broad St., Philadelphia 7, Pa., pigment, (IFB 383-1581-56), 236000 lbs, $53856.

The Min. Copper Co. Ltd., 230 California St., San Francisco 11, Cal., pigment, (IFB 383-1405-56,, 76000 lbs, $52630.

All American Engineering Co., Box U.S.S. 2668 Dupont Airport, Wilmington 5, Del., winch assys & parts, (JD 383/2150-1201/51), various, $238096.

General Laboratory Associates Inc., 17 E. Railroad Street, Norwich, N.Y., maintenance parts, (JD 383/2117-257/51), various, $79244.

Sunstrand Aviation, Sunstrand Tool Co., 2421 11th St., Rockford, Ill., junction boxes, (383/2140-2573E4/3/52), 46 ea, $42048.

Irvin Air Chute Co. Inc., 1315 Versailles Rd., Lexington, Ky., parachute assys. (383/29045-109 G3/4/56), 927 ea, $131513.

Sperry Gyroscope Co., Great Neck, Long Island, N.Y., directional indicators, (PREN 11-1264/56 & Change "A"), 183 ea, $120194.

NAVY DEPARTMENT, Bureau of Ordnance, Washington, D. C., June 18.

Victor Adding Machine Co., Chicago, Ill., maintenance and preservation of special tooling and test equipment nord 17070, job, $92487.

Aerojet General Corp., Azusa, Cal., booster rocket for various missiles, prop no. nord-27-56, nord-17118, $462141.

Kewanee Boiler Div. of American Radiator and Standard Sanitary Corp., Kewanee, Ill., 600 lb spherical float, MK 1 mod o, BuOrd LD 255783 IFB 600-1045, 56-0, NOrd-17115, 2500 ea, $148725.

New Lima Airport to Replace Old Facility

Lima, Peru—Plans to construct a new $9 million airport near the port of Callao and to spend almost $14 million for new or improved airport facilities in 18 other Peruvian communities have been announced by the government Corporation of Airports and Commercial Aviation. The new airport at Callao, which will be designed to accommodate jet transport traffic, will replace the present terminal at Limatambo in serving the Lima area.

Main runway of the airport will be 12,480 ft. long and 164 ft. wide, with approaches over the Pacific ocean, thus eliminating the hazard at Limatambo of the Andean foothills. The new field also will be further removed from a military airport south of Limatambo which now presents a traffic hazard.

The new airport will contain a two-story semicircular terminal building with a cargo basement, first floor airline and governmental offices, and second floor operations offices. Cost of the airport is expected to be more than balanced by sale of the Limatambo facility's land and terminal building.

One of the 18 sites of additional airport facilities is Tarapoto in northeastern Peru, where traffic equals that at Limatambo and is expected to increase further with expanding oil exploration activity in the area.

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Well, this may be the opportunity you have been waiting for. Because of our continued growth and increased diversification, we must expand our creative engineering staffs at both Akron, Ohio, and Litchfield Park, Arizona. Here at Goodyear Aircraft, you will find unlimited opportunity for professional development in nearly every phase of aviation. Here you will find the stimulation of creative challenge and the satisfaction of realistic accomplishment.

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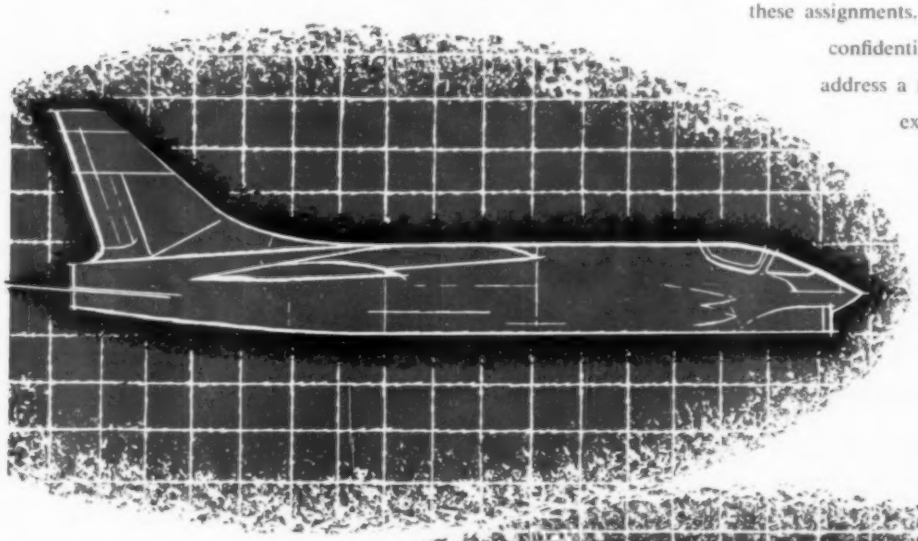

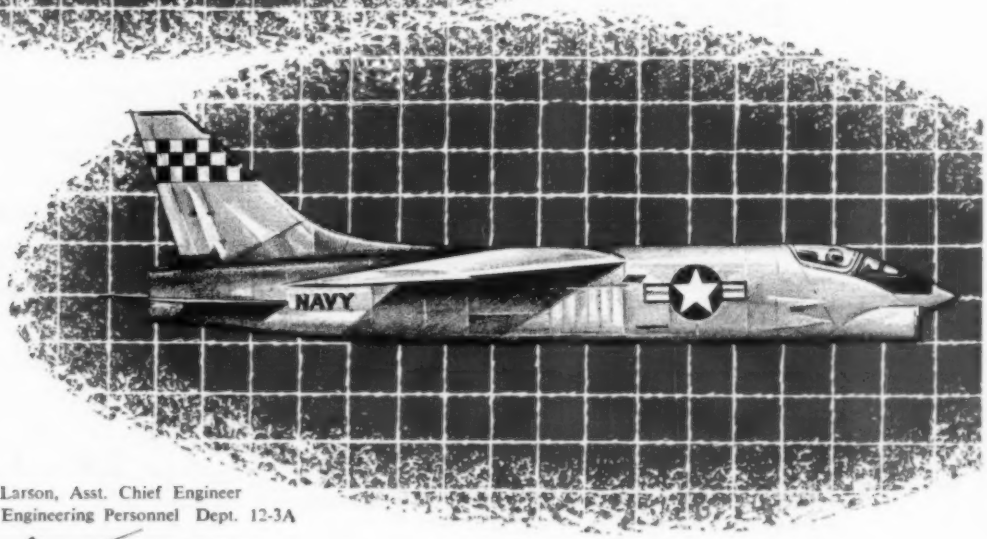

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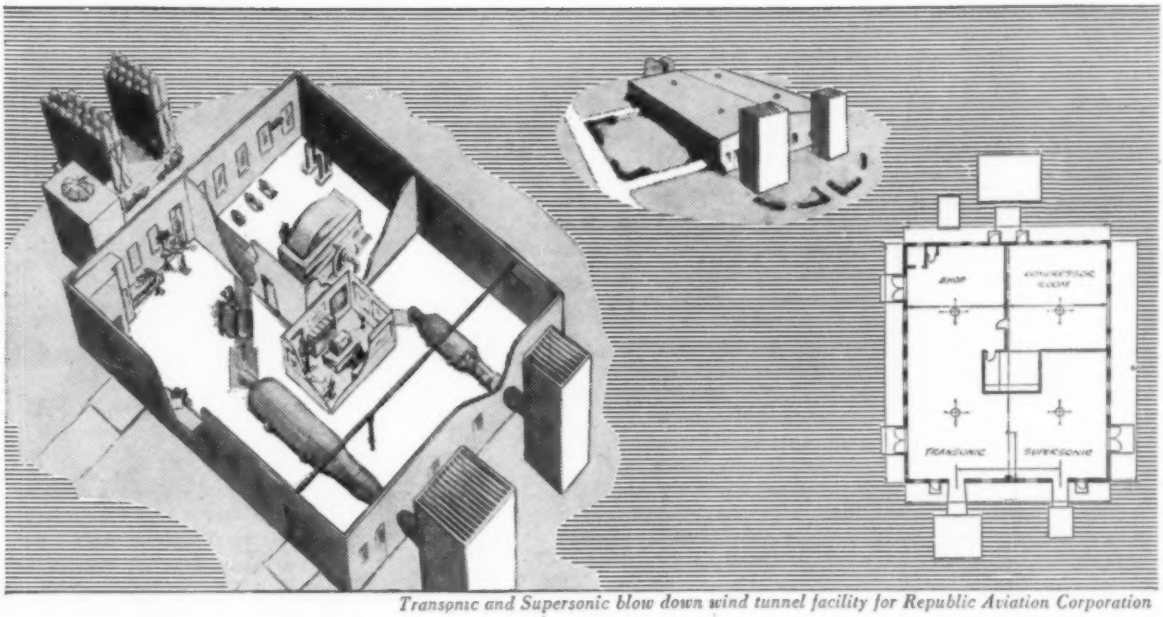

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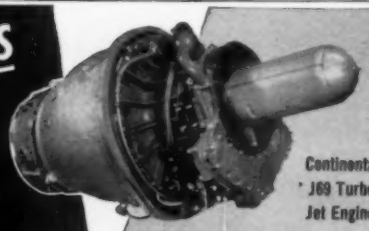

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LETTERS

S-58 Selected

I have read with a great deal of interest your series of three articles covering the procurement and use of American-built helicopters in the French Algerian area (AW Sept. 17, p. 28; Sept. 24, p. 88; Oct. 1, p. 73). Since we were following the evaluation test previously performed at Fort Rucker, and since we were vitally interested in the results, we were in a favored position to judge the accuracy of the reports. Please accept my compliments on that score.

Based on our knowledge the articles constituted a fine example of accurate and unprejudiced reporting.

As you probably know, the tests were to determine the selection of which type would be manufactured under license in France, and I am pleased to report that in the final analysis the S-58 was selected for this purpose and we have since concluded a license agreement with Sud-Est Aviation under cognizance of the French government for this purpose.

B. L. Whelan
General Manager Sikorsky Aircraft

Bendix Defense

Reader Fitzhugh's apparent alarm over the Air Force's "disgusting irresponsibilty" . . . "disregard . . . for safety and property" . . . "criminal disregard" . . . etc. . . . of the 1956 Bendix Trophy Race (AW Nov. 26, p. 122 Letters) should not go unanswered.

Be assured that flying a high performance aircraft cross-country and landing with virtually no fuel only attests to intensive flight planning, precise knowledge of the aircraft's performance and engine fuel consumption. . . . To summarize, it is precision airmanship, the same airmanship that would, if need be, enable a pilot to deliver a deep blow against an enemy and return safely home.

It is certainly agreed, that this sort of flying has no place in civil aviation. You can be sure that flying safety, which encompasses both the safeguard of our multi-million dollar machines and the people who fly and are flown in them, is of vital concern to the military. The Bendix Trophy Race is an opportunity for civilians like us, Mr. Fitzhugh, to see that the maximum is being realized from our expensive aircraft. Landing with a large fuel reserve in a Bendix Trophy Race would not prove much except poor planning.

Theodore R. Sanders
Dayton, Ohio

NACA's Problem

As a long-time NACA employe (until last September), I was very pleased with your editorial in the Nov. 5 issue. Unfortunately, you did not strike at the serious problem which is destroying the usefulness of all that fine equipment: Lack of men,

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

and particularly skilled men, to operate the facilities, analyze the data, and put it in usable report form. The Langley Laboratory had lost about 170 during 1956 at the time I left, and this has been going on for several years.

I doubt if a dozen new engineers were hired during 1956, or in any year since about 1950.

(One exception: In 1954, 33 engineers on duty with the Air Force were supplied by AF.)

What's the trouble? Just a simple matter of money. After the war the NACA had to accelerate their men through the civil service grades to keep pace with salaries in industry. In the last one or two years the inevitable happened, and all their best men began running into the top of the civil service grades GS-15. A few super grades, about six, were announced, and then about a dozen, but this only helped the top managers.

Engineers began leaving in droves and new ones could not be hired to replace them. And this in the presence of plenty of money for new construction.

The morale has dropped noticeably in the last two years.

These, of course, are the reasons why I left.

I have a number of regrets concerning my decision (considerably alleviated by a ⅓ increase in salary over NACA, however). The working conditions were fine, the freedom of activity almost unlimited (except by the amount of experienced scientific assistance available), the test facilities and supporting services the best in the country and probably in the world, etc.—all the things you stated in your editorial.

Those who have left the NACA recently (and I sit within a stone's throw of a dozen or more) are still loyal and are seriously concerned that the quality and, perhaps less but still important, the quantity of NACA output will continue to decrease.

Aviation Week's articles on the 1956 inspection have not stated these harsh facts. Somehow they must be brought home to Congress.

I really believe that this is a critical weakness in our country's technological progress. Please convey to your readers the awareness of this problem which must be vital. The impression left by your articles and editorial is that all's well with the NACA. Please call Mr. Stack if you think this is so.

I'm sure he'll tell you otherwise and welcome your support.

Former NACA Employe
Cincinnati, Ohio

Ejector Safety

Your article on the rocket-tube ejection catapult (AW Nov. 12, p. 71) was the first to make public what is generally conceded by those who have seen it to be the only current, practical solution to both the problems of high-speed and ground-level escape. This is true even in light of Martin-Baker's fine work, and the potential of the much publicized capsule. The importance of developing the capsule is granted. I would point out, though, that many millions of flight hours will be logged during the next 5-10 years in aircraft which will not be equipped with capsules. And in those same aircraft the catapults that are presently installed are inadequate for escape under many emergency conditions, as the published records of ejections show.

I have gone to considerable lengths during the past 2½ years to encourage the development of the rocket-tube principle, even to the extent of leaving Reaction Motors and forming the Fulton-Irgon Corporation with the development of aircraft safety equipment as one of its principal operations. For your article calling attention to this catapult, therefore, I am grateful. There are two points in your article, however, which should be clarified in justice to our company and to the people who are going to use rocket-tube catapults.

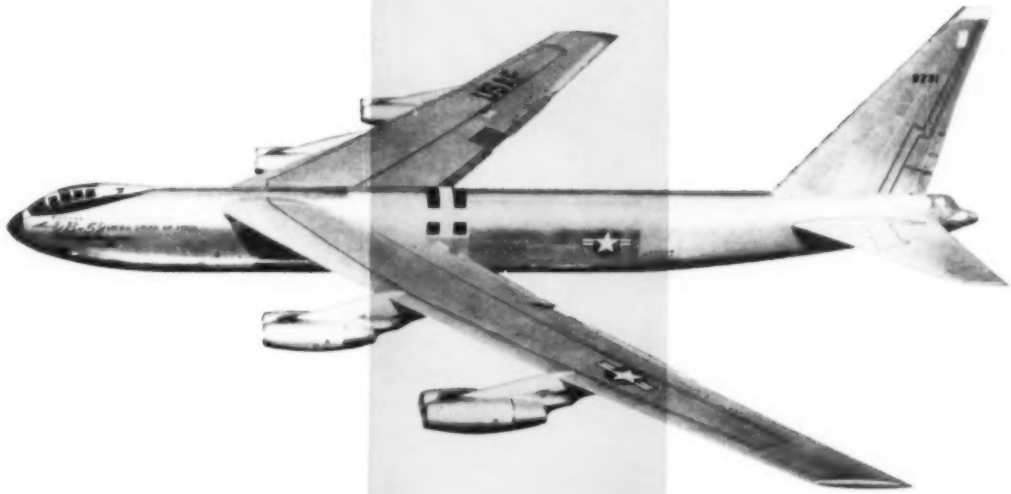
I particularly want to make clear that the schematic shown on the lead page and captioned, "Fulton's ejector . . ." is, in fact, an early Reaction Motors embodiment of the invention. Fulton-Irgon has at no time felt that this particular version could fully exploit the basic principle involved. Of the two versions you do show, frankly, we prefer the unit with the appended cartridge. Actually, both units you show suffer from the deficiency that you mention later in the article, and which is the second point I would like to clarify.

That is the question of over-all reliability. You statement that the "improved version" intensifies its own hazard, is given credence only by virtue of the units you show and describe. The statement is entirely unjustified as regards the reliability and safety inherent in the rocket-tube principle. The truth is that the rocket-tube catapult can be made safer and more reliable than existing catapults, in spite of the greater quantity of propellant used. Our company is presently developing such a unit.

Military flying is a dangerous business, even in peace time, and there will inevitably be casualties resulting from system failures and human error. It is this company's intention, though, as we are sure it is the intention of our competitors, that casualties do not result from failure of the "last resort" device meant to prevent them. Neither capsules nor rocket-tubes in any present form are the last word in ejection equipment. You will be doing a real service if you continue to factually present new developments in this neglected area as they occur.

David Fulton
The Fulton-Irgon Corp.
Bernardsville, N. J.

for SAC's new B-52 Stratofortress...



Flight Control System—by Sperry

Like every Sperry flight control system developed over the past 40 years, the MA-2 system designed for SAC's intercontinental jet bomber is "tailor-made" for the job to be done.

Providing precision control of the 650-mph Boeing plane during the long hours of navigating to distant targets, the MA-2 also supplies automatic control for the bombing system and flies the bomber during instrument landing approaches.

To meet changing control requirements of the B-52 at various speeds and at altitudes up to 10 miles or more, Sperry engineered a new design concept into the MA-2. Called "parameter control," this new development automatically determines and applies to control surfaces the exact amount of force necessary to execute any maneuver required by pilot or bombardier.

Remarkable as is the performance of the advanced MA-2 system, it is only one of many Sperry automatic flight control systems in the air today. Other Sperry systems are in use on many of the world's leading airlines, on hundreds of business planes and thousands of military aircraft. Tomorrow, new Sperry systems will be flying many of the multi-jet and turbo-prop transports now going into production.

If you have a problem in automatic flight control, Sperry engineers can help you find the right answer. Write our Aeronautical Equipment Division.

H. C. BOSTWICK, Manager of our Aeronautical Equipment Division and twenty-year Sperry veteran. Serving aviation—his experience as pilot, engineer, inventor and manager.

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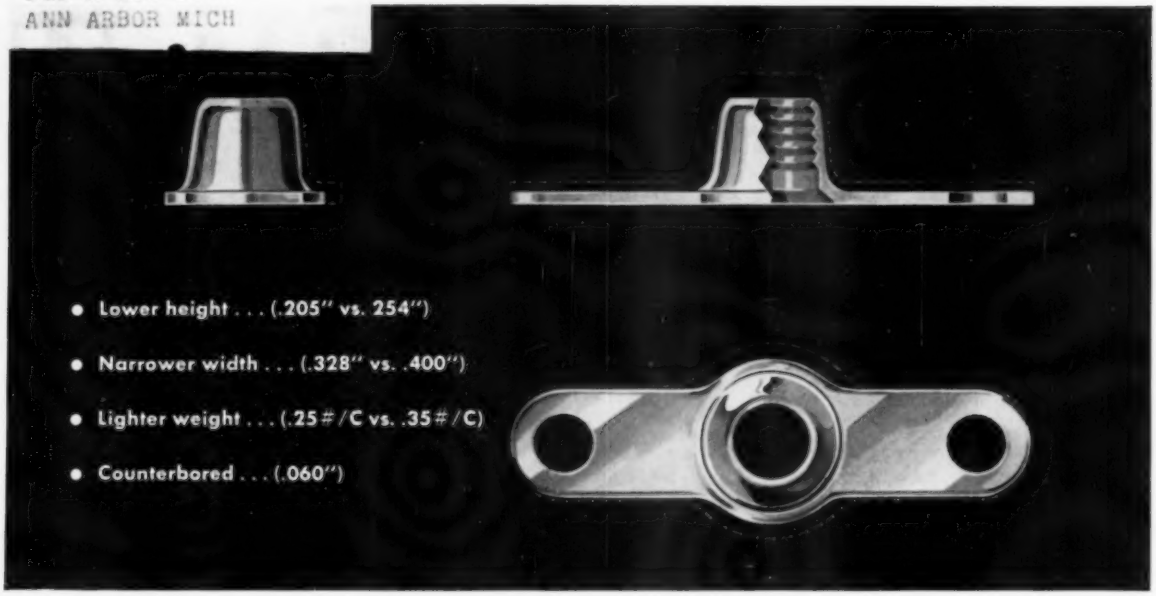

New Low-Height Counterbored Locknuts Conform with NAS Drawings

The new ESNA LHTA51 series of self-locking nuts was designed to meet the requirements of the recently released NAS679-695 drawings for low-height counterbored nuts. Intended for structural use, and developing the full tensile strength required by Spec MIL-N-25027 (ASG), they perform satisfactorily at temperatures up to 550°F. These parts have also been approved to AN-N-10 and drawings AN362 and AN366.

The LHTA51 series offers several special advantages to the designer:

Minimum envelope dimensions and weight compatible with performance to the tensile, vibration, twist-out and push-out requirements of MIL-N-25027 (ASG).

Reduced height permitting use of 160,000 psi heat treat short length NAS bolts to still further cut down weight of nut and bolt assembly.

Counterbore in the base of the nut assures that bolt threads will not be in bearing. This eliminates the weight of an extra shim in many applications.

Repeated use and reuse without loss of efficiency.

CHOOSE THE SOLUTION TO YOUR FASTENING PROBLEM FROM A COMPLETE LINE OF NUT SHAPES!

One lug Floater
(#8 through 5/16")

Two lug "Fixed" anchor
(#8 through 5/16")

Two lug "Floater"
(#8 through 5/16")

Gang Channel
(#8 through 5/16")

(and others not illustrated here)

ELASTIC STOP NUT CORPORATION OF AMERICA

MAIL COUPON FOR DESIGN INFORMATION

Dept. N18-1225, Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastening information:

☐ Spec Sheets on New LHTA51 Series

☐ Here is a drawing of our product. What type of self-locking fastener would you suggest?

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Company_____

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